READING FILE

United States Department of the Interior

FISH AND WILDLIFE SERVICE
10711 Burnet Road, Suite 200
Austin, Texas 78758
(512) 490-0057

OCT 13 2000

Consultation Number 2-15-00-F-1135
Corps Project Number 199900188

Mr. Wayne Lea
Chief, Regulatory Branch
Department of the Army
Fort Worth District, Corps of Engineers
P.O. Box 17300
Fort Worth, Texas 76102-0300

Dear Mr. Lea:

The U.S. Fish and Wildlife Service (Service) received your request dated August 31, 2000, for formal consultation on the Proposed Northern Hays County and Southwestern Travis County Water Supply System on September 5, 2000. The Lower Colorado River Authority (LCRA) has proposed to construct a water pipeline, pump stations, and storage tanks in order to extend the availability of treated surface water. In a letter dated July 20, 2000, the LCRA requested that the U.S. Army Corps of Engineers (Corps) verify that Nationwide Permit 12, for Utility Line Activities authorizes the installation of the pipeline, through one emergent wetland and seventeen streams (Corps Project # 199900188). The proposed project has the potential to affect the Federally listed golden-cheeked warbler (*Dendroica chrysoparia*) and the Barton Springs salamander (*Eurycea sosorum*).

The LCRA and Hays County have informed the Service of an emergency water situation associated with the ongoing drought within the study area. As a result, the Service agreed to expedite this consultation. This document represents the Service's biological opinion on the effects of the proposed action on the federally listed golden-cheeked warbler (warbler) and the Barton Springs salamander (salamander). This project has been assigned Service log number 2-15-00-F-1135. Please reference this number in all future correspondence concerning this project.

This biological opinion is based on: (1) the Biological Evaluation of the Proposed Northern Hays County and Southwestern Travis County Water Supply System (July 2000), prepared by PBS&J, Inc. on behalf of the Lower Colorado River Authority (LCRA), (2) the information provided as part of the informal consultation (including the Draft Environmental Assessment Report (PBS&J September 1999), (3) information in our office (including information provided by the public), (4) field investigations, and (5) other sources of information. This consultation is an initial action on this project proposal and follows roughly 18 months of informal consultation and conversations with the LCRA and more recently, the U.S. Army Corps of Engineers (Corps). The history of consultation (both informal and formal) actions follows in Table One.

Table One. Consultation History	
DATE	**HISTORY**
8 March, 1999	Meeting between Service and Lower Colorado River Authority (LCRA).
15 April, 1999	Meeting between Service and LCRA.
5,17,21 May, 1999	Meetings between Service and LCRA and stakeholders.
1 June, 1999	Meeting between the Service and Barton Springs Conservation District.
8 June, 1999	Meeting between the Service and Save Our Springs Alliance.
10 June, 1999	Meeting Between Service and Hays County Commissioner.
28 June, 1999	Service Briefing of Washington Office Staff
5, 13, 16, 27 August, 1999	Meetings between Service and LCRA and stakeholders
1, 2, 7 September, 1999	Meetings between Service and LCRA.
27 September, 1999	Service Briefing of Washington Office Staff
25 October, 1999	Meeting Between Service and Hays County Commissioner.
16 December, 1999	Meeting among Service, LCRA, and Dripping Springs Planning Group.
4 February, 2000	Public input meeting on EIS at LCRA with the Service in attendance.
6 April, 2000	Meeting between Service and LCRA.
4, 9 May, 2000	Meetings between Service and LCRA.
10 May, 2000	Meeting between Service and U.S. Army Corps of Engineers.
16, 17 May, 2000	Meetings between Service and LCRA.
2 June, 2000	Meeting between Service and LCRA.
16 June, 2000	Meeting Between Service and BioWest.
20, 22, 26, 27 June, 2000	Meetings between Service and LCRA and various stakeholders.
7 July, 2000	Meeting between Service and LCRA.
25 August, 2000	Meeting between Service and LCRA.
31 August, 2000	Public Meeting LCRA and the Service. Corps requests formal consultation.
14, 15 September, 2000	Meetings between Service and LCRA.
19 September, 2000	Service initiates consultation with the Corps.
27 September, 2000	Service sent draft opinion to LCRA and the Corps.
12 October, 2000	Corps responds to draft and designates LCRA non-federal representative.
13 October, 2000	Service issues final biological opinion

BIOLOGICAL OPINION

I. DESCRIPTION OF THE PROPOSED ACTION

The Lower Colorado River Authority (LCRA) proposes to construct a pipeline, pump stations and storage tanks in southwestern Travis and northern Hays counties to extend the availability of treated surface water. The proposed project is intended to alleviate the growing demand on groundwater resources, which is currently a concern due to increasing development and is worsened by drought conditions. The project will improve water supply reliability for those individuals and businesses in the service area that currently depend solely on groundwater sources. The LCRA and Hays County have informed the Service of an emergency water situation associated with the ongoing drought within the study area. As a result, the Service agreed to expedite this consultation.

Phase 1 is an independent water pipeline to Dripping Springs and its associated infrastructure. Although Existing and New Development for Phases 1, 2, and 3 are included in the Biological Evaluation and the proposed environmental impact study, currently the Service is consulting on impacts to proceed with Existing Development for Phase 1. New development may also be provided water as independently approved by the Service (as per the Memorandum of Understanding section below). The Service is consulting only on Phase I at this time to provide the Corps with an expedited consultation due to the drought-related emergency that may impact human health and safety.

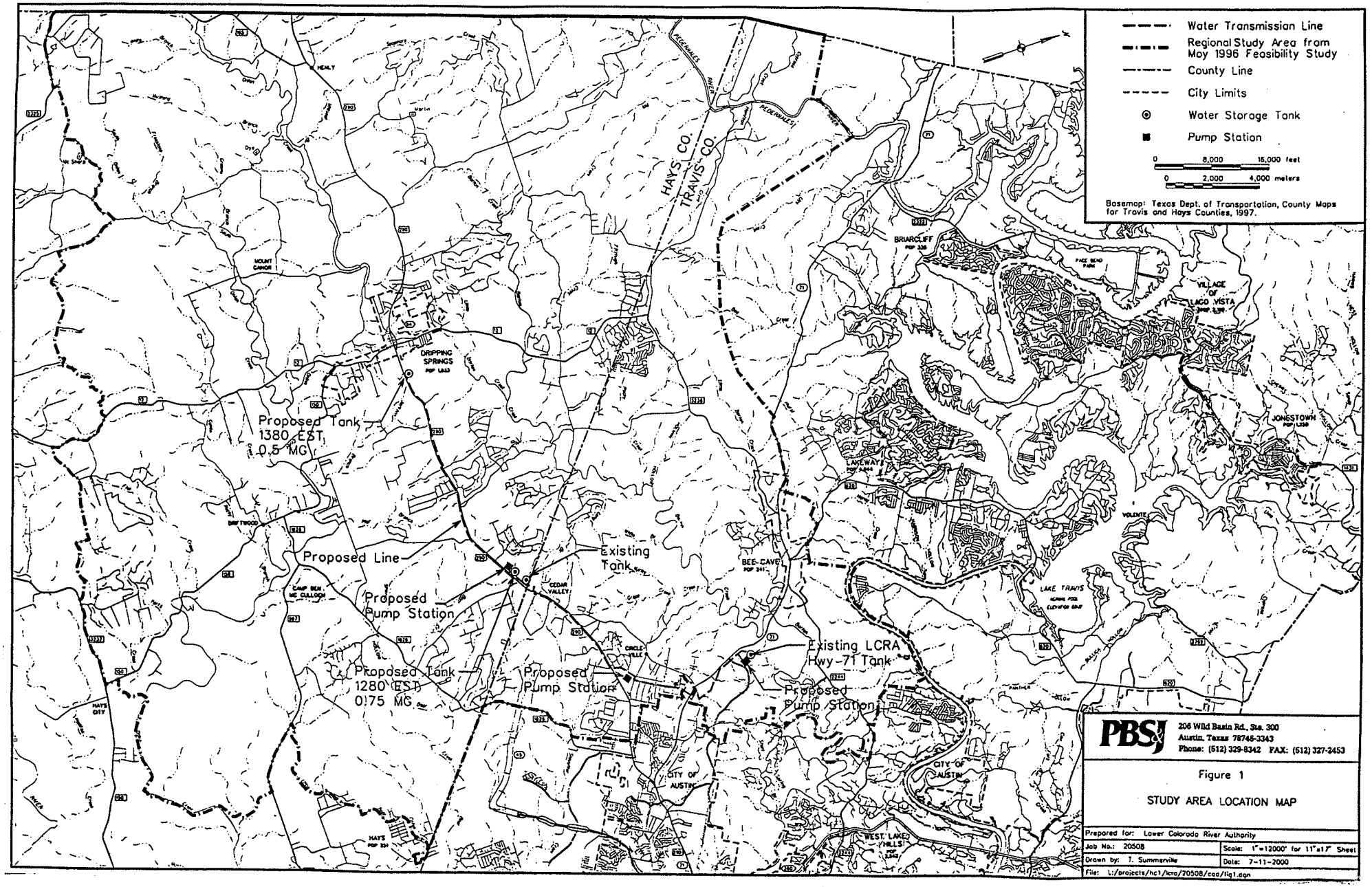
The water line would begin at the existing LCRA 1015 water tank located immediately north of State Highway (SH) 71 and Southwest Parkway in southwestern Travis County (see Figure 1). The pipeline route generally parallels roadways until it reaches the site of a future elevated water tank to be located east of Dripping Springs. This water line and associated pump stations and storage tanks constitute Phase 1 of LCRA's proposed Northern Hays and Southwestern Travis County Stage 1 Loop Water Supply System.

The majority of the action area (Figure 1.) lies within the watersheds of Barton Creek and Onion Creek and associated tributaries, primarily within the Contributing Zone of the Barton Springs segment of the Edwards Aquifer. The southeastern portion of the Onion Creek watershed within the study area is located in the Recharge Zone of the Barton Springs segment of the Edwards Aquifer. All watersheds within the study area drain directly or indirectly to the Colorado River, with the exception of a small portion of the study area in the Blanco River watershed, which drains to the San Marcos River.

Water Line Route

The selected route for the water pipeline was chosen in an attempt to maximize the use of existing right-of-ways, or parallel existing right-of-ways, to the greatest extent possible. Although most of the route will be located within private easements, almost the entire proposed route parallels existing right-of-ways. The proposed water line (about 14 miles in length) will be located within a 30-foot (ft) easement immediately outside the SH 71 and US 290 right-of-ways for the majority of its length. The pipeline easement will be cleared prior to construction to facilitate safe operation of construction equipment and access along the easement. The water line will consist of about 40,500 linear feet of 24-inch ductile iron pipe, 35,600 linear feet of 20-inch ductile iron pipe, and associated accessories. The pipe will be buried to a minimum depth of four feet from the top of the pipe.

Figure 1. Study Area Location Map



The proposed water line route follows existing road corridors for almost its entire length. The route also parallels existing water lines owned by the City of Austin and the Hill Country Water Supply Corporation for much of the length. By paralleling existing right-of-ways, the LCRA has avoided and minimized potential impacts to the greatest extent possible. In addition, LCRA has reduced the proposed right-of-way to the least width possible (30-50 feet) for construction. The permanent easement is 30' for the entire route. Where the waterline goes along roads, the total right-of- way is 30', because construction can be done from the road. In areas where it is not along the road, a temporary 20' easement has been added for construction. During construction, LCRA will implement an erosion and sedimentation control plan that is designed to reduce and minimize impacts to surface waters. In addition, a post-construction plan will return the right-of-way to preconstruction contours and the right-of-way will be seeded with native species to reduce and minimize potential impacts.

Potential existing customers represent about 4,630 connections (or about 11,800 people). This consists of about 2,500 existing improved lots and about 2,130 existing platted lots or approved residential development containing platted lots that have readily available electric utility service and direct access to an existing street. With an average density of 3.5 acres per connection, the number of connections for undeveloped platted lots would include an area of about 7,500 acres. In addition to the 4,630 connections to existing development, the Phase 1 waterline has the potential to serve about 2,970 additional connections (7,600 people). Removing the 11,800 people (4,630 connections) potentially using groundwater from the Trinity Aquifer could result in a reduction of up to 2,775 gallons per minute (gpm) withdrawal from the aquifer.

Memorandum of Understanding

The LCRA and the Service have signed a Memorandum of Understanding (MOU) for the purpose of providing treated surface water for residents in western Travis and northern Hays counties (Appendix 1). As part of the MOU, the LCRA has agreed to participate in this formal section 7 consultation with the Corps and the Service.

The LCRA has agreed to prepare an environmental impact study to evaluate the impacts of new development on water quality and the salamander. Water service to New Development (as defined in the MOU, Appendix 1) can be provided in one of three ways:

1. By demonstrating compliance with the Final Water Quality Protection Measures, approved by Service, following completion of the environmental impact study. Interim Water Quality Measures, provided as part of the Biological Opinion, will be evaluated by the environmental impact study to develop the Final Water Quality Protection Measures within 90 days following completion of the study.

2. By working directly with the Service and obtaining a letter, biological opinion, or habitat conservation plan, from the Service, that demonstrates compliance with the Endangered Species Act.

3. If a regional solution, acceptable to the Service is developed and implemented, then New Development in compliance with the approved regional standards could be provided water service.

The LCRA and Hays County have informed the Service of an emergency water situation associated with the ongoing drought within the study area. Therefore, the Service has agreed to expedite this consultation to evaluate the installation of the water pipeline for service Existing Development and New Development as approved by the Service. This biological opinion may be revised in accordance with the section 7 regulations once the environmental impact study is completed.

Endangered Species Protection Measures

The Endangered Species Protection Measures described below are divided along species lines and they are further divided to address the potential impacts from pipeline installation and water service to Existing Development. Potential impacts to the salamander and the warbler are addressed separately. The Endangered Species Protection Measures were designed to address three main pathways for potential impacts:

1. Direct impacts from the installation of the main pipeline.

2. Direct impacts from the installation of the secondary lines that deliver water service to Existing Development.

3. Indirect impacts of providing water service to the 2,128 undeveloped lots within the Existing Development covered under Phase 1.

This initial consultation on the waterline does not provide coverage to landowners or developers for any impacts they may have to Federally listed species. The responsibility for compliance with the Endangered Species Act for impacts on the warbler, and/or the salamander, if any, remains with the landowner. However, LCRA has incorporated measures to limit impacts and facilitate compliance with the Endangered Species Act for individual landowners (see below).

Golden-cheeked Warbler

To address the direct impacts of pipeline installation, the LCRA will conduct the pipeline and pump station construction and operation in a manner that avoids potential effects to listed species and habitat. The main pipeline will impact 18 acres of Zone 2 warbler habitat. The Balcones Canyonlands Conservation Plan (BCP) defines Zone 2 habitat as unconfirmed warbler habitat. The LCRA has agreed to utilize its BCP credits to offset for impacts to Zone 2 warbler habitat and has obtained approval from the BCP Coordinating Committee (Appendix 2). The provisions set forth in the MOU will also minimize impacts to the warbler, as well as minimizing impacts to surface and ground water quality in the Edwards Aquifer recharge zone and contributing zone.

Direct impacts from the installation of the secondary lines that deliver water service to the residences and businesses will be constructed in such a way as to avoid impacts to the warbler. LCRA will implement the following restrictions within known or potential habitat for the warbler.

- To the extent feasible, secondary water lines will be placed in roads or in previously cleared road rights-of-way;
- Clearing will be limited to a construction area no more than 16 feet in width;
- Clearing will take place only outside of the breeding season (i.e., clearing will occur during the August through February time frame);

- If the above restrictions cannot be met, LCRA will meet with the Service to discuss an acceptable solution.

To address potential direct and indirect impacts to the warbler of providing water service to the 2,130 undeveloped lots within the Existing Development covered under Phase 1, LCRA will implement the following measures:

1. Within 60 days from the date of this Biological Opinion, LCRA will provide a current aerial photograph (1 inch: 400 feet or larger scale) of the entire service area with an overlay of all Existing Developments and developed and undeveloped lots.

2. Within 90 days from the date of this Biological Opinion, the Service, with assistance from LCRA, will identify areas of suitable habitat for the warbler on the aerial photograph.

3. Upon receipt of a request for water service, if the requestor's undeveloped lots occur within potential habitat for the warbler, LCRA will notify the requestor of the options listed below, to ensure compliance with the Endangered Species Act. The leaflet describing warbler habitat (Campbell 1995) and current Texas Forest Service brochures on oak wilt prevention will accompany each notification to landowners.

    a. Under this Biological Opinion, single-family lot owners may pursue an expedited process to ensure compliance under the Endangered Species Act, which includes limiting development to 0.75 acres and providing funds ($1500) to either the Balcones Canyonlands Preserve or National Fish and Wildlife Foundation prior to initiating development, and conducting clearing and construction outside of the breeding season (see Appendix 3). These funds will be used exclusively for the conservation and recovery of the warbler, including acquisition and management of habitat;

    b. Hire a biologist who has scientific permits necessary to conduct 3 years of presence/absence surveys for the warbler. Following the Service's review of the survey information, if the species is not present, the landowner may proceed without further consultation with the Service. If the species is present, the landowner may purse option a or c; or

    c. Work with the Service to receive an individual 10(a)(1)(B) permit under the Act prior to initiating development.

LCRA's environmental impact study will also evaluate the impacts of new development on the warbler as well as the endangered black-capped vireo (*Vireo atricapillus*). During the interim period, New Development will be required to address water quality impacts in accordance with the MOU and the Service would include in its independent evaluation the impacts on the black-capped vireo (vireo) and warbler.

Black-capped Vireo

An assessment of habitat for the vireo was performed from field reconnaissance, the Endangered Species Habitat and Potential Preserve System maps for the Balcones Canyonlands Conservation Plan (BCCP), and from 1995 color digital ortho- quarter-quads (DOQs). The field reconnaissance was performed along the waterline alignment. Outside the proposed water line easement, the habitat

assessment was performed using the BCCP maps for areas in Travis County, and the DOQs for areas in Hays County. No suitable habitat for the vireo was identified along the proposed water line alignment.

Few endangered species surveys have been conducted within the action area. The closest known vireo sightings are on the Balcones Canyonlands Preserve, about 3,000 feet east of the proposed water line. Two other sightings in 1999 occurred 6 and 7 miles south of Highway 290 in Hays County, near tributaries to Little Bear and Onion creeks (Service, unpublished data).

Without field reconnaissance, vireo habitat is difficult to identify using conventional methods, including aerial photography and satellite imagery. A cursory assessment of potential habitat was performed for Existing Development, generally within two miles of either side of the proposed pipeline alignment. About 10 subdivisions greater than two miles from the line were included since they have contacted the LCRA requesting water service. The initial assessment of potential habitat was performed from interpretation of the 1995 DOQs using a process of elimination. Mature woodlands, pastures, and developed areas were excluded, while areas with about 30 to 60 percent cover were included. Based on a preliminary review of the Existing Development, 1700 acres were identified as needing field reconnaissance to determine if suitable vireo habitat exists.

On September 27 and 28, PBS&J senior staff ecologists conducted a field reconnaissance of the entire 1700 acres. Because the height of the woody species and the type of species can not be determined from aerial photo interpretation, the areas identified on the aerial photograph were found to be either savannah, pastures that have been reinvaded by Ashe juniper, or other plant communities that are not suitable for the vireo. Since no vireo habitat was found during the field surveys, this species is not addressed further in this Biological Opinion. Therefore, the proposed action is not likely to adversely affect the vireo and no further consultation is needed on this species for the proposed waterline and service to Existing Developments.

Barton Springs salamander

To address the impacts of pipeline installation (both the main pipeline and secondary lines), to the salamander, the LCRA will implement an erosion and sedimentation control plan that is designed to reduce and minimize impacts to surface waters. This plan will comply with the Texas Natural Resources Conservation Commission's Edwards Aquifer Rules and with the Environmental Protection Agency's requirements for Storm Water Pollution Prevention Plans.

In order to educate existing landowners to the sensitivity of the area, upon receipt of a request for water service, LCRA will work with the retail water service providers to ensure that all customers are provided with information on living lightly on the aquifer and a copy of the Water Quality Protection Measures. The Service and the LCRA will work cooperatively to develop an educational brochure to be distributed to landowners on steps they can take to protect water quality.

To cover potential impacts to the salamander of providing water service to the 2,130 undeveloped lots within the Existing Development covered under Phase 1, LCRA will work with the retail water service providers to ensure that all requestors are notified of their responsibility to comply with the Endangered Species Act.

To protect the salamander, the water quality protection measures attached to the MOU are designed to prevent degradation of surface waters and the aquifer. Specifically, the water quality protection

measures include the establishment of buffer zones along drainages in the Barton Springs watershed, low impact development designs, provisions for increased development intensity with offsite mitigation, stormwater treatment, erosion/sedimentation controls, maintenance plans, and environmental education. The LCRA will conduct an environmental impact study to further consider the potential impacts of the proposed water supply system. The Service and LCRA anticipate that this study will further analyze the potential direct, indirect, and cumulative effects of water service to New Development.

As agreed to in the MOU, the Service and LCRA are providing Interim Water Quality Protection Measures. The Service and LCRA, since the adoption of the MOU, have worked with a group of consultants from the environmental community, the development community, and the City of Austin, to refine the Water Quality Protection Measures. The Service sent these measures, dated September 1, 2000, out as recommendations for water quality protection, in a letter to Federal Agencies on September 5, 2000. The Interim Water Quality Protection Measures are attached as Appendix 4. These measures will be analyzed in the environmental impact study. These measures will also serve as recommendations for individual developers working directly with the Service to obtain a letter, biological opinion, or habitat conservation plan, from the Service that demonstrates compliance with the Endangered Species Act.

II. STATUS OF THE SPECIES/CRITICAL HABITAT

The following is a review of the status of the golden-cheeked warbler and Barton Springs salamander, their occurrence within the action area, and potential impacts from the proposed project. The Service has reviewed the list of threatened and endangered species and identified potential impacts to the warbler and the salamander. There has been no critical habitat designated for these or any listed species within the action area for this project.

A. Golden-cheeked Warbler (*Dendroica chrysoparia*)

Status and Distribution of the Golden-cheeked Warbler.

The warbler is a small, insect-eating songbird, 4.5 to 5 inches long, with a wingspan of about 8 inches. The male has a black back, throat, and cap; and yellow cheeks with a black stripe through the eye. Females are similar, but less colorful. The lower breast and belly of both sexes are white with black streaks on the flanks (Campbell 1995).

The warbler breeds only in the mixed Ashe juniper-deciduous woodlands of the central Texas Hill Country west and winters primarily in the pine-oak woodlands of southern Mexico and northern Central America. The warbler requires the shredding bark of mature Ashe junipers for nesting material and forages for insects in Ashe juniper and various deciduous tree species (Service 1992). Warblers need a combination of mature Ashe juniper and hardwood trees in their nesting habitat. Typical nesting habitat is found in tall, dense stands of Ashe juniper mixed with trees such as Texas (Spanish) oak, shin oak, live oak, post oak (*Quercus stellata*), Texas ash (*Fraxinus texensis*), cedar elm (*Ulmus crassifolia*), hackberry (*Celtis* spp.), sycamore (*Platanus occidentalis*), Arizona walnut (*Juglans major*), escarpment black cherry (*Prunus serotina*), and pecan (*Carya illinoiensis*). Mature juniper trees vary in age and growth form, depending on site factors. Generally, trees required for nesting habitat are at least 20 years old and 15 feet tall (Campbell 1995).

Male warblers arrive in central Texas in early to mid-March and begin to establish breeding territories, which they defend against other males by singing from visible perches within their territories. The females usually arrive a few days later than the males. Eggs are generally incubated in April and

fledging usually occurs in May. If their initial nesting attempt fails, birds may not fledge young until early June. By late July, the warblers begin their migration south (Campbell 1995).

Densities of warblers vary depending on habitat quality. To allow for the presence of some unoccupied areas within expanses of occupied, suitable habitat, Pulich (1976) estimated 1 pair/20 acres for "good" habitat, 1 pair/50 acres in "average" habitat, and 1 pair/80 acres in "marginal" habitat to calculate warbler population size for range-wide expanses of oak-juniper woodland (USFWS 1992).

The warbler was listed as endangered under emergency listing procedures in May 1990 (55 FR 18844), and under normal listing procedures in December of that same year (55 FR 18846), due to imminent and on-going destruction of habitat. The greatest threats to the warbler's continued existence are habitat loss and fragmentation, primarily from urban expansion. Agricultural activities have eliminated much warbler habitat within the central and northern parts of the warbler's range. The heart of the warbler's range lies along the rapidly urbanizing corridor between San Antonio and Austin, and thus efforts to protect its remaining habitat are essential to prevent its extinction (Service 1992).

Research indicates that a common factor in the decline of several neotropical migratory passerines is habitat degradation and/or destruction in core breeding areas, which are needed to provide a source of immigrants to less productive areas (Robinson 1992, Donovan et al. 1995a, Donovan et al. 1995b). Research on the warbler suggests that occupancy and productivity are considerably lower in "small" patches of habitat than in larger ones (Coldren 1998; Maas 1998).

Based on 1979 and 1997 satellite imagery data, the warbler's habitat is concentrated along the eastern and southern edges of the Edwards Plateau. Travis County is one of the counties with the greatest amount of warbler habitat in large, contiguous blocks, and it lies at the center of the species' range. Habitat in northern Hays County is smaller and more patchy than in southern Hays County or the adjacent Travis and Comal counties. Currently there are only three large populations receiving some degree of protection: the Balcones Canyonlands Preserve, the nearby Balcones Canyonlands National Wildlife Refuge, and at Ft. Hood Military Reservation.

Like many habitat specialists, warbler populations appear to be less stable in small habitat patches surrounded by urbanization (Engels 1995, Moses 1996, Arnold et al. 1996, Bolger et al. 1997, Coldren 1998). Some studies indicate that the abundance of several bird species, including the warbler, is reduced within 656-1640 feet of an urban edge (Engels 1995, Arnold et al. 1996, Bolger et al. 1997, Coldren 1998). Coldren (1998) reported that warbler occupancy and productivity declined with increasing residential development and roadway width. Additional information on the status of this species can be found in the Warbler Recovery Plan (Service 1992) and Warbler Population and Habitat Viability Assessment Report (Service 1996b).

B. Barton Springs Salamander

Status and Distribution of the Barton Springs Salamander.

The federally listed endangered salamander is known only from Barton Springs in Zilker Park, in Austin, Texas (62 *Federal Register* 23377), and has one of the smallest geographical ranges of any vertebrate in North America (Aquatic Biological Advisory Team 1995). This aquatic species depends on a constant supply of clean, flowing water from four spring outlets that are collectively known as Barton Springs: Barton Springs Pool, Eliza Spring, Old Mill Spring, and Upper Barton Spring. The area that provides water to these spring outlets (the Barton Springs segment of the Edwards aquifer and its contributing

zone) is referred to as the Barton Springs watershed and is a critical component of the salamander's ecosystem (62 *Federal Register* 23377). Barton Springs is the primary discharge point for the Barton Springs watershed (Slade et al. 1986, Hauwert et al. 1998).

The ecosystem, upon which the salamander depends, is the Barton Springs watershed. The water that flows from Barton Springs originates as rainfall on the lands in the contributing and recharge zones of the Barton Springs segment of the Edwards Aquifer. This 354-square mile drainage makes up the Barton Springs watershed and influences the quality of water flowing out of Barton Springs. Good water quality is essential to the health of the salamander. Because of its restricted distribution and location at the end of the aquifer system, the salamander may be subjected to water quality pollutants that reach the aquifer.

In addition to a constant flow of clear, clean water, the salamander depends on shelter among aquatic plants, in leaf litter, and under gravel and rocks; and an abundant variety of prey items. The salamander was reportedly abundant among aquatic vegetation in the deep end of Barton Springs Pool during collections made in 1946 (Chippindale et al. 1993). Plant species at Barton Springs include *Cabomba caroliniana*, *Sagittaria platyphylla*, *Ludwigia repens*, and *Potamogeton illinoiensis* (Bassett Maguire, University of Texas at Austin, personal communication, 1995), *Zannichellia palustris*, *Najas guadalupensis*, and *Amblystegium riparium* (City of Austin 1998a).

The salamander appears to be an opportunistic feeder, consuming live invertebrates small enough to catch and swallow. Chippindale et al. (1993) reported finding amphipod (*Hyalella azteca*) remains in the stomachs of wild-caught salamanders. The gastrointestinal tracts of 18 salamanders found dead in the wild contained ostracods, copepods, midge larvae, snails, amphipods, mayfly larvae, leeches, and beetles (City of Austin, unpublished data, 1999). Representatives of at least 20 orders of aquatic invertebrates have been collected from Barton Springs (City of Austin, unpublished data, 1999), which may provide food for the salamander. Recorded specimens include the damselfly (Zygoptera) genera *Enallagma* and *Argia*; several families of dragonflies (Anisoptera); six families of true bugs (Hemiptera), including *Criphocricus hungerfordi* and *Gerris* sp.; several families of mayfly (Ephemeroptera) and caddisfly (Trichoptera); at least six families of aquatic beetles (Coleoptera), including the "water penny" beetle *Psephenus texanus*; true flies (Diptera) and alderflies (Megaloptera); ostracods; copepods; hydras; aquatic worms (oligochaetes, nematodes); triclad flatworms of the genus *Dugesia*; leeches; water mites (hydracarina); amphipods (*Hyalella azteca*, *Artesia subterranea*); branchiopods; several species of snails, including *Stygopyrgus bartonensis*; limpets; and isopods, including *Lirceolous smithii*.

The salamander is totally aquatic and neotenic (it does not metamorphose into a terrestrial adult). The salamander is lungless and relies on a pair of conspicuous red gills located behind the head for obtaining oxygen. Bryce C. Brown and Alvin Flury first collected specimens of the salamander in 1946 (Chippindale et al. 1993). In Barton Springs Pool, salamanders are found primarily near the spring outlets, the fissures area west of the diving board, and the beach area on the north side of the pool (City of Austin 1998a). Salamanders are also found at Eliza Spring, Old Mill Spring (Sunken Garden), and Upper Barton Spring (Chippindale et al. 1993, City of Austin 1998a).

To date, no evidence exists to determine to what degree the range of the salamander extends into the aquifer (City of Austin 1998a). Since food supplies are more limited in the aquifer due to the absence of photosynthesis, salamanders are likely concentrated near spring openings where food is abundant, water

chemistry and temperatures are relatively constant, and where salamanders have immediate access to both surface and subsurface habitats (62 *Federal Register* 23377).

Population estimates for the salamander are not possible at this time because the technology to safely and reliably mark salamanders for individual recognition has not been developed. However, anecdotal information indicates the salamander was more abundant prior to the 1980's than today (Chippindale et al. 1993, City of Austin 1998a and unpublished data, 1993-2000). City of Austin monthly survey counts since 1993 in Barton Springs Pool have ranged from 1 to 86 individuals (City of Austin 1998a and unpublished data, 1993-2000). These surveys represent a subsample of the total number of salamanders inhabiting the pool. The number of individuals found during periodic searches throughout the entire pool may be three to five times the number counted during the regular monthly surveys. A comprehensive search following drawdown of the water level, when salamanders are easier to find, reported a high of 101 individuals (City of Austin 1998a).

"Dozens or hundreds" of individuals were found at Eliza Spring during the 1970's (Chippindale, et al. 1993). Numbers observed since 1987 have varied from 0 to 188 (Chippindale et al. 1993, City of Austin and Service, unpublished data, 1995-2000). The highest number, 188, was observed in 1997 following drawdown of the water level. The highest number observed during a routine survey was 38 (City of Austin 1998a and unpublished data, 1995-2000).

Salamanders have been found sporadically in the bottom of Old Mill Spring, its springrun, and the confluence of the springrun and Barton Creek. Salamanders are difficult to find at Old Mill Spring due to the deep layer of large rocks that covers the bottom of the springs, which makes it easier for salamanders to escape and hide. Numbers observed have varied from 0 to 60 (City of Austin and Service, unpublished data, 1996-2000). The highest observed was 60 during a survey that covered half of the spring area (City of Austin 1998a and unpublished data, 1996-2000).

In April 1997, City of Austin and Service staff discovered 14 adult salamanders at Upper Barton Spring, which flows intermittently. Numbers since that time have ranged from 0 to 14 at this site (City of Austin 1998a and unpublished data, 1997-2000). Various attempts to locate salamanders at Cold Springs, Campbell's Hole, and Backdoor Springs have failed to locate salamanders. No salamanders have been found at any other sites in the Barton Springs watershed (Chippindale et al. 1993, Russell 1996, City of Austin 1998a).

Water Quality

This discussion of water quality information covers Barton Springs water quality, groundwater quality, water quality of the creeks that provide recharge to the aquifer, and sediment quality. Sediment is separated out because it originates on the surface and in the aquifer, pulses through the aquifer, and emerges at Barton Springs. Sediment can carry an attached pollutant load and is a pollutant itself.

Barton Springs Water Quality

In a recent analysis performed by the City of Austin (2000), significant trends were reported for several chemical constituents in Barton Springs. The significance and presence of trends are variable depending on flow conditions (baseflow vs. stormflow, recharge vs. non-recharge) and are attributed primarily to the cumulative impacts of urbanization and increased groundwater use (City of Austin 2000). Conductivity, sulfate, turbidity, and total organic carbon showed increases over time, while the

concentration of dissolved oxygen decreased (Table 1). This is the first data to indicate a long-term trend in water quality degradation at Barton Springs.

The U.S. Geological Survey (USGS 2000) sampled Barton Springs Pool, Eliza Spring, and two creeks (Barton Creek and Williamson Creek) for soluble pesticides during and after a 2-day storm event. Information on the surface water streams is summarized below (see Surface Water Quality). Positive detections of four pesticides (atrazine, carbaryl, diazinon, and simazine) were reported in both Barton Springs Pool and Eliza Spring. Atrazine and simazine are used as herbicides whereas carbaryl and diazinon are insecticides. At Barton Springs, peak concentrations of the four pesticides detected at the two springs were 0.56 µg/l for atrazine, 0.013 µg/l for carbaryl, 0.028 µg/l for diazinon, and 0.011 µg/l for simazine. A residue of atrazine, deethylatrazine was also detected at a peak concentration of 0.033 µg/l Concentrations of these pesticides are below criteria set in the aquatic life protection in the State of Texas Surface Water Quality Standards and in health advisories (USGS 2000); however, increases in peak concentrations for the pesticides found in the USGS study could adversely affect aquatic organisms.

Some of the pesticides commonly used in urban areas degrade rapidly in the environment, but certain pesticides may remain biologically active for extended periods of time (Eisler 1986, Hill 1995). For example, diazinon, which is commonly used in commercial and residential areas, may remain biologically active in soils for up to 6 months under conditions of low temperature, low moisture, high alkalinity, and lack of microbial degraders (Eisler 1986). Diazinon has shown adverse effects on stream insects at concentrations of 0.30 µg/l (Eisler 1986). To ensure protection of sensitive aquatic fauna, Eisler (1986) recommends that levels of diazinon in water not exceed 0.08 µg/l.

Several heavy metals, including arsenic, cadmium, copper, lead, nickel, and zinc, as well as sediment of possible anthropogenic origin have been detected in Barton Springs (City of Austin 1997). Old Mill Spring appears to be affected by urbanization as indicated by detection of heavy metals, pesticides, and total petroleum hydrocarbons (City of Austin 1997). The Barton Springs/Edwards Aquifer Conservation District detected high concentrations of total lead (0.024 mg/l) and dissolved lead (0.015 mg/l) at Old Mill Spring (Hauwert and Vickers 1994, BS/EACD 1994). The EPA drinking water standard for total lead is 0.015 mg/l.

Table 1. The magnitude and percent change in selected water quality constituents over a 20 to 25 year time period at Barton Springs in Zilker Park in Austin, Texas. This table was adapted from the City of Austin, Environmental Resources Management, Watershed Protection Department's Water Quality Report Series (COA-ERM 2000-2) (May18, 2000).

		Normalized Period Medians			
Parameter	Flow Condition	1975-1979 or 1980-1984^ Median	1995-1999 Median	Change over approx. 20 years	Percent Change ($p \leq 0.05$)
Dissolved Oxygen (mg/l)	Baseflow without Recharge	6.8	5.7	-1.1	-16%

Organic Carbon (mg/l)	Storm flow	1.5	3.4	1.9	127%
Specific Conductance (µS/cm)	Baseflow without Recharge	655	677	22	3%
	Baseflow with Recharge	590^	646	56	9%
	Storm flow	624	642	18	3%
Sulfate (mg/l)	Baseflow without Recharge	28.3^	38.8	10.5	37%
Turbidity (NTU)	Storm flow	5.3	7	1.7*	32%*

^ Actually 1980, 1983 & 1984, since 1981 & 1982 were removed from the analysis due to a sewer line break

* Significant at the 0.1 level, but not at the 0.05 level

In aquatic environments, dissolved lead is the most toxic form, and adverse effects (including reduced survival, impaired reproduction, and reduced growth) on aquatic invertebrates and fish have been reported at concentrations of 0.001 to 0.005 mg/l (Eisler 1988a). Aquatic organisms may absorb lead through skin, gills, intestines, and other organs, and may ingest lead while feeding (Pain 1995). Lead concentrations tend to be highest in benthic (bottom-dwelling) organisms, which may assimilate lead directly from sediments (Eisler 1988a). Research indicates that lead is not essential or beneficial to living organisms, and that all known effects are deleterious, including those on survival, growth, reproduction, development, behavior, learning, and metabolism (Eisler 1988a, Hoffman et al. 1995, Pain 1995). Adverse effects increase with elevated water temperatures, reduced pH, younger life stages, and long exposures (Eisler 1988a, Pain 1995). Synergistic and additive effects may also occur when lead is mixed with other metals or toxic chemicals (Eisler 1988a). Sources of lead in water may include industrial discharges, urban runoff, and sewage effluent (Pain 1995).

Since water quality at Barton Springs is heavily influenced by the quality and quantity of stormwater runoff, the severity of contamination at the springs is expected to increase as urbanization continues to expand over the watershed.

Groundwater Quality (salamander)

Studies indicate that groundwater quality in the more heavily developed areas of the Barton Springs watershed is showing signs of degradation (Slade et al. 1986, City of Austin 1991a, 1991b, 1993, Hauwert and Vickers 1994, Texas Groundwater Protection Committee 1995). Slade et al. (1986) reported that levels of fecal-group bacteria, nitrate nitrogen, and turbidity were highest in wells near creeks draining developed areas, with total nitrogen concentrations typically two to six times higher in developed areas than in rural areas. The Barton Springs/Edwards Aquifer District also found elevated levels of sediment; fecal-group bacteria, trace metals, nutrients, and petroleum hydrocarbons were in

springs and wells in urban areas (Hauwert and Vickers 1994, Texas Groundwater Protection Committee 1995). Increased nutrients such as nitrate-nitrogen indicate degrading water quality and promote eutrophication of aquatic ecosystems, including the growth of bacteria, algae, and nuisance aquatic plants, and lowered oxygen levels (Menzer and Nelson 1980).

Arsenic, which has been used in the manufacture of agricultural pesticides and other products (Eisler 1988b) and may be found in roadway runoff and urban runoff, has been detected in wells in the Barton Springs watershed at levels exceeding the EPA drinking water standards (0.05 mg/l) (Hauwert and Vickers 1994). Concentrations of arsenic compounds adversely affecting aquatic life have been reported at 0.019 to 0.048 mg/l (Eisler 1988b).

At least six cases of groundwater contamination with gasoline and/or diesel have been reported on the Barton Springs watershed. Three major petroleum pipeline spills have occurred over the watershed in the last 20 years, two of which occurred over the recharge zone (Rose 1986; Texas Railroad Commission, unpublished data, 1999). Visible free-phase petroleum and petroleum products including benzene, xylene, toluene, and MTBE have been detected in the aquifer and at Barton Springs.

Surface Water Quality (salamander)

A major threat to water quality in the aquifer and at Barton Springs is associated with changes in land use that degrade the quality of stormwater runoff. The surface water quality represents the most substantial influence on water quality and is the factor that can be most easily controlled. Direct surface runoff can carry contaminants and other toxic materials that are washed off the land surface. Surface water quality can vary substantially among areas draining different land uses. The location, amount, and type of impervious cover, point source contamination and stormwater treatment facilities can all alter the quality of runoff entering the aquifer.

Studies in the Barton Springs watershed indicate that the mean concentrations for most water quality constituents are lower in undeveloped than developed areas. Several studies specific to the Barton Springs watershed demonstrate degradation of surface water quality in and downstream from developed areas, including algal blooms, erosion, trash and debris, and accumulation of sediment and toxic chemicals (Slade et al. 1986, Slade 1992, City of Austin 1991a, 1991b, 1993, 1995, 1997; Hauwert and Vickers 1994, Johns and Pope 1998). Stormwater runoff has been monitored routinely in the recharge and contributing zones through a variety of programs including the EPA National Urban Runoff Program, USGS monitoring stations, and small watershed stormwater monitoring performed by the City of Austin. Veenhuis and Slade (1990) reported that the quality of stormflow was degraded at sites in streams with relatively developed basins. Increases associated with urbanization have been documented for many water-quality constituents, such as total suspended solids, biological oxygen demand, total organic carbon, nitrate nitrogen, ammonia nitrogen, Kjeldahl nitrogen, phosphate, copper, iron, lead, zinc, fecal coliform, and fecal streptococci (City of Austin 1990, Veenhuis and Slade 1990). Increases in turbidity (a measure of suspended solids or sediment), algal growth, nutrients, and fecal-group bacteria have been documented along Barton Creek downstream from State Highway 71 and have been largely attributed to construction activities and the conveyance and treatment of sewage in the area (Slade et al. 1986; City of Austin 1991a, 1991b, 1993). Construction activities can also increase the concentrations of other materials in stormwater runoff. Several hazardous materials spills associated with construction activities in the Barton Springs watershed have been documented between 1988 and 1998. These incidences ranged from diesel spills to improper cleaning of painting and concrete equipment.

The USGS (2000) water quality sampling included surface water samples from Barton Creek and Williamson Creek. Peak concentrations of three pesticides detected during the 2-day storm event were 0.80 µg/l for atrazine, 0.47 µg/l for carbaryl, and 0.26 µg/l for diazinon. The peak concentration for the deethylatrazine residue of atrazine was 0.03 µg/l. The peak carbaryl concentration in the USGS study (0.47 µg/l) is close to the acute criteria for waterflea, *Daphnia magna*, at 0.83 µg/l (EPA 2000) as calculated from the Texas Surface Water Quality Standards (TNRCC 1997) and EPA's Pesticide Ecotoxicity Database (EPA 2000). Diazinon can cause adverse effects on stream insects at concentrations of 0.30 µg/l, and levels should not exceed 0.08 µg/l to ensure protection of sensitive aquatic fauna (Eisler 1986). Atrazine was detected at levels below acute criteria for sensitive aquatic organisms.

Sediment Deposition and Quality (salamander)

Sediment from soil erosion has been cited as the greatest single pollutant of surface waters by volume and the potential carrier of many pollutants found in water (Menzer and Nelson 1980). Construction activities can generate large amounts of sediment that greatly exceed natural erosion rates. During construction activities, disturbed soil is easily eroded and carried off by runoff during storm events. As development in the watershed increases, sediment discharge from construction sites is likely to increase (City of Austin 1997). Alteration of soil cover, drainage patterns, and the physical characteristics of the soil itself during construction and landscaping may also increase the concentration of sediments in storm water discharge from developed sites (Virginia Department of Conservation and Recreation 1992).

An important portion of the sediment discharging from the aquifer originates at the surface (Mahler et al. 1999). Sediments discharging to karst aquifers play a fundamental role in determining water quality (Mahler et al. 1999). Sediments have both a direct impact on habitat quality and can act as a transport mechanism for other contaminants (Menzer and Nelson 1980). Karst systems are more vulnerable to the effects of pollution because of their thin surface soils, high groundwater flow velocities, and the relatively short time water is resident within the system (Ford and Williams 1994). Surface derived sediments have the greatest potential to concentrate and transport contaminants because of their high organic carbon content and their potential exposure to contaminants at the surface (Mahler and Lynch 1999).

Increased concentrations of sediments in discharge may impact aquatic organisms in several ways (EPA 1986; Schueler 1987). Increases in turbidity due to increases in suspended sediments in the water column can disrupt behavioral and cellular processes in aquatic organisms by impairing the organisms ability to locate food resources or potential mates and avoid predators (EPA 1986; Schueler 1987). Suspended sediments can impact respiratory processes by direct smothering or clogging of gill structures (Garton 1977; Werner 1983; Schueler 1987). Sediment build-up in source areas can also block recharge that could otherwise enter into sinkholes, caves, and other recharge features (EPA 1986; Schueler 1987), and could consequently influence water quantity at Barton Springs.

Research indicates that species in or near contaminated sediments may be adversely affected even if water-quality criteria are not exceeded (Landrum and Robbins 1990, Medine and McCutcheon 1989). Sediments act as a sink for many organic and inorganic contaminants (Menzer and Nelson 1980, Landrum and Robbins 1990, Medine and McCutcheon 1989) and can accumulate these contaminants to levels that may impact aquatic ecosystems (Landrum and Robbins 1990, Medine and McCutcheon 1989).

Sediment data from Barton Creek show very high levels of polycyclic aromatic hydrocarbons, a component of oil, at two sites above Barton Springs pool (City of Austin 1997). Polynuclear or polycyclic aromatic hydrocarbons (PAHs) are a group of organic compounds characterized by two or more fused aromatic rings. Levels that exceed the "Apparent Effects Threshold" for biological effects (Ingersoll et al. 1996) have been reported for benzo (a) anthracene, benzo (a) pyrene, chrysene, dibenz (a, h) anthracene, flourene, phenathrene, pyrene, and total polycyclic aromatic hydrocarbons (City of Austin 1997, 1998b.)

Data have shown PAH contamination in the sediments of Barton Creek directly upstream of Barton Springs and at Lost Creek Boulevard. Sediments collected from the main stem of Barton Creek in 1994 contained several PAHs that were 2.5 to 22 times the levels shown to always have a toxic effect (survival, growth, or maturation) on *Hyalella azteca* (Ingersoll et al. 1996, City of Austin 1998b). *Hyalella azteca* is a known prey item for the salamander. Sediments collected from Barton Springs also contained PAHs at levels up to 6.5 times those shown to be toxic to *Hyalella azteca* (Ingersoll et al. 1996, City of Austin 1998b).

Several pesticides have been detected in sediments in Barton Creek (City of Austin 1997). Pesticides detected include aldrin, DDD, DDE, DDT, delta-BHC, endosulfan I, endrin, gamma-BHC, heptachlor epoxide, heptachlor, and lindane (City of Austin 1997). While their reported concentrations, to date, have been relatively low, their presence alone is cause for concern. Many of the identified pesticides may result in adverse effects to the salamander or its prey base after short-term exposures. Exposure may include contact with or ingestion of contaminated water, sediments, or food items (Hill 1995).

Trace metals, such as arsenic, cadmium, copper, lead, nickel, and zinc, were measured in the sediments of Barton Springs in the early 1990s. These data indicate that concentrations are higher at sites downstream of development (City of Austin 1997). Preliminary results from the USGS's large volume suspended sediment analysis for Barton Springs have found elevated levels of arsenic (20 mg/kg) and zinc (1800 mg/kg) in the suspended sediment discharged from Barton Springs during a storm event (Barbara Mahler, USGS, personal communication, 1999). Arsenic and zinc are used in the manufacture of agricultural pesticides and other products and may be found in roadway and urban runoff. Heavy metals attached to sediment at these concentrations could have toxic effects on the prey species at the springs (Ingersoll et al. 1996) and may have toxic effects on the salamander. The USGS results are considered preliminary and provisional until additional corroborative data can be collected. USGS staff will publish this data in USGS Fact Sheets and in other peer-reviewed publications (Barbara Mahler, USGS, personal communication, 1999).

III. ENVIRONMENTAL BASELINE

A. Golden-cheeked Warbler

Status of the Species Within the Action Area.

Habitat for the warbler is dispersed throughout the action area and occurs within Existing Development, in undeveloped areas, and within the BCP. Potential habitat for the warbler is more widespread in southern Hays County and adjacent Travis and Comal counties, but also occurs in fragmented patches in northern Hays County. These habitat patches are believed to be important to maintain connectivity between the larger source populations and population viability of the species.

Because the warbler occupies mature woodlands, areas of potential habitat are much easier to identify using satellite imagery and aerial photography than for the vireo, although field reconnaissance is still necessary to confirm presence or absence of the species. An assessment of potentially suitable habitat for the warbler was performed from field reconnaissance, the Endangered Species Habitat and Potential Preserve System maps for the BCCP, and from the 1995 DOQs. The field reconnaissance was performed along the waterline alignment. Outside the proposed water line easement, the habitat assessment was performed using the BCCP maps for areas in Travis County, and the DOQs for areas in Hays County. About 22,000 ft of Zone 2 habitat for the warbler occurs along the proposed water line alignment in Travis County. The Balcones Canyonlands Conservation Plan defines Zone 2 habitat as unconfirmed warbler habitat.

No suitable habitat for the warbler occurs along the proposed water line easement in Hays County. However, limited endangered species surveys in this area have documented warblers within the action area, including sightings within the BCP on both sides of Highway 71; throughout Friendship Ranch in 1994, about 2 miles south of Highway 290; along Pier Branch in 1999, less than 2 miles south of Highway 290; and along Long Branch in 1994, about 1 mile north of Highway 290.

An assessment of potential warbler habitat in Hays County was performed for Existing Development, generally within two miles of either side of the proposed pipeline alignment. About 10 subdivisions greater than two miles from the line were included since they have contacted the LCRA requesting water service. The habitat assessment was performed from interpretation of the DOQs based on vegetative cover, and did not take into account proximity to development, fragmentation, or habitat patch size. Field verification was performed in conjunction with the habitat mapping effort by PBS&J senior ecologists on October 9 and 10, 2000. Based on the photo interpretation and field reconnaissance, about 900 acres of potential warbler habitat occurs within existing developments in Hays County within the approximate 4-mile corridor.

Factors Affecting the Warbler Environment Within the Action Area.
Travis and Hays counties lie near the heart of the warbler's range and contain large amounts of habitat (Service 1992). The smaller habitat patches in northern Hays County may provide important links between the larger habitat patches in southern Hays and adjacent counties. The entire area from San Antonio to north of Austin, where the majority of the warbler's habitat is concentrated at the center of the species range, is under immediate and intensifying pressures from urban expansion.

B. Barton Springs Salamander
Factors Affecting the Barton Springs Salamander Environment.
In the Final Rule listing the salamander as endangered (62 Federal Register 23377), the primary threats or reasons for listing were identified as the degradation of the quality and quantity of water that feeds Barton Springs resulting from urban expansion over the watershed. These threats were projected to result in the "destruction, modification, or curtailment of the species habitat or range." The factors contributing to these threats include "chronic degradation, catastrophic hazardous materials spills, increased water withdrawals from the aquifer, and impacts to the surface habitat." Impacts to the surface habitat have been addressed in the Habitat Conservation Plan for Barton Springs (City of Austin 1998a) and are not further addressed. The water quality at Barton Springs results from a complex mixture of watershed land use patterns and natural processes.

Mechanisms and pathways, by which existing development adversely impact the salamander, cannot be enumerated precisely with the present state of knowledge about the species and the watershed. As indicated in the recent dye study report by the BS/EACD (Hauwert et al. 1998), hydraulics affecting recharge and discharge localities, pathways, and rates are only beginning to be determined with any degree of accuracy and are likely to be more variable than previously considered. Far more complicated are the mechanisms and pathways by which the salamander population may be influenced by the frequency and duration of adverse conditions caused by urbanization in the watershed. Therefore, a conservative approach is taken to identify threats and conservation efforts using data gathered elsewhere coupled with local data.

Water Quality Threats (salamander)

Urban Expansion.
Austin is a fast-growing metropolitan area. As human population growth increases impervious cover, changes in pollutant loading and transportation in the Barton Springs watershed are projected to increase. An estimate of population growth through 2040 is provided (Table 2.). As population increases so do the pressures on natural resources and, in this case, threats to the salamander and its ecosystem.

Table 2. Population Estimates for the Barton Springs Watershed. Adapted from the City of Austin's Biological Assessment for an Environmental Protection Agency, National Pollutant Discharge Elimination System, Municipal Separate Storm Sewer System Permit (NPDES Permit Number TX000401). Environmental Protection Agency, Dallas Texas.

Barton Springs Watershed	Acres	1996 Population	2040 Population	Population Increase
Population	236,955	55,384	285,558	416%

Source: City of Austin Planning Department based on Traffic Serial Zone Data

Impervious Cover.
The single most consistently useful indicator of watershed quality is overall impervious cover (Schueler 1994). Even at relatively low levels of impervious cover "profound and often irreversible impacts to the hydrology, morphology, water quality, habitat, and biodiversity of streams" can occur (Schueler 1994). Both nationally and locally, including the Barton Springs watershed, consistent relationships between impervious cover and water quality degradation have been documented. No single regulatory mechanism is currently in place over the entire Barton Springs watershed that restricts impervious cover.

Riparian Buffers.
Riparian areas are the land next to streams that provide shade, streambank stability, and filtration of upland runoff. Filtering is accomplished by making use of soil capacity, vegetation, and microorganisms to remove or break down pollutants (Mulamoottil et al. 1996). This relatively small proportion of the landscape is much more important to the proper hydrological and ecological functioning of ecosystems than their small size would indicate (Vannote et al. 1980, Gregory et al. 1991). No single regulatory mechanism is currently in place over Barton Springs watershed to restrict development of riparian areas along major creeks or headwater tributaries.

Wastewater Systems.
The primary sources of wastewater discharge to the environment that may be of concern in the recovery of the salamander are septic tank fields, organized sewage collection systems, and irrigation disposal of partially treated wastewater. Threats are present from direct impact of bacteria; nutrient enriched algal blooms, discharge of oxygen demanding organic material, and concomitant discharge of toxic pollutants commonly found in domestic wastewater.

Water Quality Controls (Best Management Practices).
Maintained water quality filters generally remove 30-70 % of the levels of most water-quality constituents (Glick et al. 1998). The data indicate that best management practices mitigate water-quality pollutant loading but do not prevent water-quality degradation caused by urbanization (Glick et al. 1998). Maintenance of water quality treatment structures is also a long-term problem (City of Austin 1998b).

Golf Courses.
Golf courses, despite great care in turfgrass management techniques, contribute runoff containing elevated levels of nutrients through fertilization. Pesticides are also elevated in golf course runoff despite best efforts to manage the application of chemicals (City of Austin 1997). Currently, four 18-hole golf courses are operated in the Barton Springs watershed with plans for at least eight more. Elevated baseflow nutrient levels and algae blooms on the mainstem of Barton Creek have been observed to be concentrated in the immediate vicinity of golf courses using reclaimed wastewater (City of Austin 1997).

Transportation Infrastructure.
Highways can have major impacts on groundwater quality (TNRCC 1994, Barrett et al. 1995). The TNRCC lists highways and roads as the fifth most common potential source of groundwater contamination in the Edwards aquifer. Highway operation and maintenance increases concentrations of pollutants from vehicles and roadway runoff, which are transported to sensitive areas such as Barton Springs.

Hazardous Materials Spills.
Spills are an unpredictable, yet potentially important source of pollutants for a sensitive urbanizing watershed such as that contributing to Barton Springs. Spill impacts are expected to increase as watershed population density increases due to 1) a corresponding increase in the frequency of spills, 2) faster spill movement over impervious cover and 3) expedited delivery to local creeks via storm sewer systems. The City of Austin's spill database, when regressed against impervious cover, indicates a strong empirical relationship between spill risk and impervious cover (City of Austin 1998b).

Water Quantity.
Another threat to the salamander and its ecosystem is low flow conditions in the aquifer and at Barton Springs. Discharge decreases as water storage in the aquifer drops, which historically has resulted primarily from a lack of recharging rains rather than groundwater withdrawal for public use. However, increased demands for water from the aquifer can also reduce the quantity of water in the Barton

Springs watershed. Groundwater pumpage increases considerably and its effects on aquifer levels and springflows become more pronounced during dry periods (Hauwert et al. 1998).

Summary (salamander)
The effect of pollutants on living organisms is a complex interaction between the pollutant and synergistic effects of multiple pollutants, the organism, and the environment (Rand et al. 1995). Each class of contaminant (sediment, petroleum hydrocarbons, heavy metals, and pesticides) can have different effects on aquatic ecosystems (Hoffman et al. 1995). In the natural environment, these impacts may be complicated by the presence of other contaminants. Though only limited data are available on the vulnerability of the salamander to toxic effects from pollutants, much is known about the effects of various compounds on many other aquatic species. These data lead to a concern that negative impacts from pollutants to the salamander and/or its prey base are already occurring.

The salamander is vulnerable to pollutants emanating from Barton Springs. There is a relatively high incidence of toxic chemicals, in toxic amounts, being found in the surface waters, groundwater, sediment transport system, and at Barton Springs. Heavy metals, petroleum hydrocarbons, pesticides, and sediment have been found in and near salamander habitat. Given the threats of increased urban development, increased risk of hazardous materials spills, and increased groundwater pumping, the Service believes that the continued existence of the Barton Springs salamander may be in jeopardy, without implementation of adequate water quality protection measures in the watershed.

IV. EFFECTS OF THE ACTIONS

This section includes an analysis of the direct, indirect, of the proposed action on the listed species and the interrelated and interdependent activities and cumulative effects.

A. Golden-cheeked Warbler

Direct Effects.
The proposed waterline alignment crosses about 22,000 ft (4.2 miles) of Zone 2 warbler habitat in Travis County (City of Austin and Travis County 1996). No suitable habitat was identified along the proposed alignment in Hays County. Assuming a 30-ft construction easement along SH 71, and a 40-ft construction easement along the remainder of the line, the project will impact about 18 acres of Zone 2 habitat. The LCRA investigated routing the line along the east side of SH 71, but this would have impacted at least two warbler territories east of SH 71 (Melton 1999). Routing the line west of SH 71 will avoid impacts to known warbler territories. In order to avoid and minimize impacts to the warbler, any water line construction required in areas of Zone 2 habitat will take place outside the breeding season (see Project Description).

LCRA proposes to minimize impacts to the warbler by participating in the BCCP, or regional section 10(a)(1)(B) permit for Travis County. LCRA credits will be used to minimize impacts to the warbler (Appendix 2).

No direct impacts from installation of secondary lines are anticipated. If any secondary water lines occur in potential habitat areas, impacts will be avoided by placing these lines in roads or in previously cleared road rights-of-way, limiting clearing to a construction area no more than 16 feet wide, and conducting all clearing activities outside of the breeding season (i.e., clearing will occur during the

August through February time frame). These avoidance measures are in accordance with the Service's "no take" guidelines for the warbler (Campbell 1995).

Indirect Effects.
Indirect impacts to the warbler are likely to occur from providing water service to the remaining undeveloped lots within the Existing Developments covered under Phase 1. An analysis of the potential habitat within Hays County for Existing Developments that may be served by the waterline indicates about 900 acres of warbler habitat could be impacted from development of currently undeveloped lots. This development would add to the currently fragmented nature of warbler habitat in northern Hays County. These areas may provide important links in maintaining dispersal between larger populations in Travis and southern Hays/Comal counties. The loss and/or degradation of 900 acres of warbler habitat is equivalent to the loss or reduction of 10 to 45 pairs of warblers (based on density estimates of one pair per 20 to 80 acres, USFWS 1992). Because of the level of existing build-out, the loss of the remaining small and isolated habitat fragments within the Existing Development is not anticipated to have a major impact on the species as a whole.

To further refine the amount of estimated warbler habitat and identify which remaining undeveloped lots contain suitable warbler habitat, LCRA will provide a current aerial photograph (1 inch: 400 feet or larger scale) of the entire service area with an overlay of all Existing Developments and developed and undeveloped lots within 60 days from the date of this Biological Opinion. Within 90 days from the date of this Biological Opinion, the Service, with assistance from LCRA, will identify areas of suitable habitat for the warbler on the aerial photograph.

Once the potential habitat areas have been refined, LCRA will minimize potential indirect impacts by notifying requesters of water service for lots within the habitat areas of their options for ensuring compliance with the Endangered Species Act. These options, which are described in more detail in the Project Description and Appendix 3, include limiting the extent and timing of clearing and providing funds to specific conservation entities; conducting surveys to document whether the species uses the potential habitat; and/or obtaining a Section 10(a)(1)(B) permit from the Service. However, the Service is unable to predict how many landowners will comply with the ESA.

Cumulative Effects.
Cumulative effects include effects of future, State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Endangered Species Act. Cumulative effects in the action area may include unauthorized clearing and construction within habitat areas, activities that increase nest parasitism by brown-headed cowbirds and predation (including the spread of fire ants and predatory birds and mammals), application of pesticides and herbicides, and increased grazing pressure by deer, goats, and other herbivores. These activities will further fragment the warbler's habitat and reduce its occupancy and reproductive success within the remaining habitat fragments in northern Hays County.

B. Barton Springs Salamander
Factors to be considered.
Proximity of the Action. The salamander is not found in the action area. The action area for this consultation encompasses the potential service area of the system (Figure 1). However, the action area does have an impact on the water quality at Barton Springs, the only known location of the salamander.

This area, the Barton Springs watershed, is a critical component of the ecosystem upon which the salamander is dependent.

Distribution. Barton Springs is the only known location of the salamander. The action area is a large geographic area where development associated with the water pipeline can occur. Not all development in this area will be associated with the water pipeline.

Timing, Nature, and Duration of the Effects. The constant flow of water and relatively constant temperature at Barton Springs provide habitat conditions that are suitable for reproduction all year. All life stages of the salamander and its preybase must be assumed to be present at all times. The potential effects to the salamander would involve the delivery of pollutants through the aquifer system to salamander habitat. The timing, nature, and duration of the effects will be a continual process.

Disturbance Frequency, Intensity, and Severity. The timing for delivery of pollutants to salamander habitat will be related to storm events within the watershed. The hydrology (rainfall, runoff, and delivery to the aquifer) and sediment transport through the aquifer system will drive the delivery of pollutants from the study area to Barton Springs. The intensity and severity of these effects will be highly variable.

Analyses For Effects Of The Action.

Direct Effects.

Direct effects are the immediate effects of the project on the species or its habitat. The salamander will not be directly impacted by construction of the water pipeline. Because the salamander is not found within the study area, any effects to the species would be indirect and/or cumulative.

Indirect Effects.

Indirect effects are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. Indirect effects may occur outside the area directly affected by the action. The water quality of surface streams within the study area can impact salamander habitat. The delivery of pollutants through the aquifer system to salamander habitat will happen later in time and are considered reasonably certain to occur.

For Phase 1, the water service connections will consist of up to 4,630 connections. This consists of about 2,500 existing improved lots and about 2,130 existing platted lots or residential developments containing platted lots that have readily available electric utility service and direct access to an existing street. The 2,500 existing improved lots are subdivisions that have houses already in place. The 2,130-platted lots may be developed in the future.

There will indirect effects associated with the service to Existing Development. Removing the 4,630 connections (11,800 people) potentially using groundwater from the Trinity Aquifer could result in a reduction of up to 2,775 gallons per minute (gpm) withdrawal from the aquifer. This groundwater, depending on local aquifer conditions, could then be available for other uses including new development, golf course irrigation, or other uses.

The 2,500 existing improved lots currently have impacts on the water quality. These impacts are already part of the environmental baseline and the provision of surface water should not have any additional effect.

The 2,130-platted lots will result in an increase in population of about 4,500 people assuming about 2 people per connection. As population increases so do the pressures on natural resources and, in this case, threats to the salamander and its ecosystem. The 2,130-platted lots may also have effects from construction and long-term effects related to urban development that are not currently included in the baseline. The build-out of those subdivisions and platted lots are currently planned under existing rules and regulations. The roads that would serve the platted lots are already built and are therefore part of the environmental baseline. Individual landowners would still be responsible for impacts from construction and urban development and LCRA has agreed to ensure that the landowners are notified of this responsibility. LCRA will also ensure that these landowners are provided with information to assist in complying with the Endangered Species Act (see Project description above).

LCRA has estimated the overall density of these developments to be 3.5 acres per water service connection. With this density, vegetated areas should be available to mitigate some of the impacts of this residential construction and urban development on water quality. Urban development has been documented to result in water quality degradation (see Status of the Species and Environmental Baseline above). Impervious cover has been used as a surrogate for determining the overall impact of urban development and is strongly correlated with impacts at various densities. The density of these developments should be fairly low as long as the lots are not further subdivided. Wastewater systems could create long-term problems but the level of treatment and type of treatment will be variable throughout the action area. Herbicide and pesticide use on these areas could result in pollutant runoff. Under existing regulations riparian buffers will serve to lessen impacts associated with the platted lots.

Species response to a proposed action.

Numbers of individuals/populations potentially affected. This factor relates to a species or populations ability to respond to the loss of individuals. In the case of the salamander, the entire known population of salamanders would be potentially affected by changes in water quality that result from the proposed action. The proposed action would result in changes in water quality at Barton Springs. These changes would be manifested in along several potential effect pathways. Overall water quality during storm events could have increased levels of pesticides, heavy metals, and/or petroleum hydrocarbons. The effect of these increases would be dependent on the total concentration of the pollutants. Increased pesticides, heavy metals, and/or petroleum hydrocarbons could impact the breeding, feeding or sheltering ability of the species if the threshold effects concentrations were exceeded. Another potential pathway for effects to be manifested would be pulses of sediment with pollutants attached. These pulses would move through the aquifer system and would have an impact if the sediment were deposited into salamander habitat. This could make small areas of habitat unsuitable for salamanders. Sediment with pollutants attached may also be available for ingestion by prey species in the salamander habitat. There could be some level of bioaccumulation of pollutants in the food chain. The exact number of individuals affected is impossible to predict but the entire population could potentially be impacted.

Sensitivity to change. This factor relates to the degree to which a species or population is prone to change when disturbed. The salamander and its ecosystem have been subjected to many different stresses and changes. The ecosystem has been greatly altered from its historic condition. This ecosystem appears to be able to respond to small-scale changes in water quality.

Resilience. This factor relates to the characteristics of species or populations allowing them to recover from different magnitudes of disturbance. Defining the actual level of the impact of water quality degradation on the salamander is very difficult. The impacts probably occur during stormflows and the population cannot be safely observed during stormflows. Stormwater can carry both dissolved pollutants and contaminated sediment. The contribution of pollutants from the action area will be pulsed through the ecosystem with seasonal rainfall events. The potential for disturbance of the water quality at Barton Springs may last for many years. The addition of pollutants to the aquifer system and the travel time for these pollutants would be highly variable. Some sediments with pollutants attached may reside in the aquifer for long periods of time (years). These sediments could be mobilized by any storm and have the potential to be delivered to salamander habitat. We have little to no information on the resilience of the salamander or its preybase.

Recovery rate. This factor relates to the time required for an individual, population, species, community, or ecosystem to return to equilibrium after exposure to a disturbance. The potential for disturbance of the water quality at Barton Springs may last for many years. As with resilience we have little to no information on the recovery rate of the salamander or its preybase.

Cumulative Effects.
Cumulative effects of future State, local or private actions that are reasonably certain to occur in the action area are considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Endangered Species Act.

Roadway and other infrastructure construction and land development activities within the project area are required to comply with numerous other state and local regulatory controls. The Capital Area Metropolitan Planning Organization has developed a proposed roadway plan that addresses future roadway construction in the study area. Local governments and private developers may also build new roadways. Construction of new roadways in northern Hays and southwestern Travis counties may result in adverse environmental impacts to the salamander. The degree to which these actions will involve Federal agency actions is not clear at this time.

Current and future land development projects in the northern Hays County and southwestern Travis County area also present the potential for environmental impacts to sensitive resources. Among the factors that potentially impact water quality from development of the area of concern is the general lack of centralized wastewater service. The rate and density of development may be expected to increase if wastewater service is provided in the future, unless limited by water quality protection measures. The degree to which these actions will involve Federal agency consultation pursuant to section 7 of the Endangered Species Act is not clear at this time.

The lack of a regional growth management plan and the unclear future of Federal government involvement with growth, in this watershed, lead to a serious concern about protecting the habitat (water quality) of the salamander. Many activities in addition to those mentioned above have the potential to impact water quality. A regional plan for growth management that addresses water quality issues in a comprehensive manner may be the only way to protect water quality in the long-term.

V. CONCLUSION

The Service in developing its biological opinion has thoroughly reviewed the proposed action submitted by the Corps and LCRA. In consideration of the above and after reviewing the current status of the potentially affected species, the environmental baseline for the action area, the effects of the proposed action including direct, indirect, and cumulative effects, it is the Service's biological opinion that the action as proposed by the Corps and LCRA, is not likely to jeopardize the continued existence of any Federally listed species. In addition, the proposed action is not likely to destroy or adversely modify the designated critical habitat of any listed species.

This Biological Opinion is based on the description of the proposed action presented earlier in this document. The LCRA and Hays County have agreed that there is an emergency water situation in this area, and have informed the Service of the situation. The Service is not an expert in this field and is relying on the determination made by the LCRA and Hays County. The Service agreed to expedite this consultation to provide water for Existing Development while New Development will be addressed comprehensively in the environmental impact study. The terms Existing Development, New Development, and environmental impact study, are defined in the MOU (Appendix 1).

The Service believes that installing the water pipeline to provide water to Existing Development would not constitute irretrievable commitments of resources for the purposes of section 7(d) of the Endangered Species Act. The LCRA has committed not to provide water service to any New Development without the concurrence of the Service on whatever water quality protection measures will be used for individual developments. Service concurrence with Final Water Quality Protection Measures, regional standards for water quality protection, or an individual development's compliance with the Endangered Species Act, must not result in jeopardizing the continued existence of any listed species.

Because the Service may not be able to concur with the water quality protection measures that result from the environmental impact study, an alternative of no water service to New Development exists. The LCRA is installing the water pipeline with the knowledge that it may not be able to serve any New Development. Therefore, although LCRA's resources are being committed, the Service believes that this commitment does not constitute an irreversible or irretrievable commitment of resources, natural or monetary, which have the effect of foreclosing the formulation or implementation of any reasonable and prudent alternatives or measures.

For the warbler, existing mechanisms, under the Endangered Species Act, exist to prevent incidental take of this species. Each individual development is required to be in compliance with the Endangered Species Act regardless of whether they are receiving water from the pipeline. The LCRA, in implementing the construction of the pipeline and its facilities, has ensured that any take of the warbler or its habitat will be avoided and/or minimized.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by FWS to include significant habitat modification or degradation

that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by FWS as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary, and must be undertaken by the Corps so that they become binding conditions of any grant or permit issued to the LCRA, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require the (applicant) to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the [agency or applicant] must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(i)(3)]

This incidental take statement is based on full implementation of the proposed project as described in the Description of the proposed action section of this biological opinion, including conservation measures that were incorporated into the project design. Of particular importance is that private developers adhere to the conservation actions identified for each species for which take exemption is sought.

Failure to implement the project as proposed (including any relevant conservation measures), or implementation of the project in a manner that causes an effect to listed species or designated critical habitat not adequately considered in this opinion may cause coverage of section 7(o)(2) to lapse and require reinitiation of consultation to ensure compliance with section 7(a)(2) of the ESA.

AMOUNT OR EXTENT OF TAKE

The Service anticipates that the level of incidental take from the proposed activities will be relatively low. The amount or extent of incidental take resulting from the proposed action on listed species is difficult to assess since potential impacts will be indirect.

A. Golden-cheeked Warbler

The proposed installation of the waterline will result in the loss of 18 acres of Zone 2 warbler habitat in Travis County. The anticipated take (harm or harass) of warblers would be 1 pair; no take is anticipated in Hays County. LCRA proposes to minimize impacts to the warbler by participating in the BCCP, or regional section 10(a)(1)(B) permit for Travis County.

A preliminary habitat analysis indicates that a maximum of 900 acres of warbler habitat could be adversely impacted from development of currently undeveloped lots. The Service anticipates that this development will result in the take of up to 45 pairs warblers in the form of harm and harassment. Once the potential habitat areas have been refined, LCRA will notify requesters of water service for lots within the habitat areas of their options for ensuring compliance with the ESA (as described in the Description of the proposed action section). Take that occurs only from actions implemented consistent

with proposed project design and Appendix 3 of this opinion is exempted through this take statement. The Service will track the development of the lots and associated ESA compliance.

B. Barton Springs Salamander

The Service is not permitting any take of the salamander. The existing lots that are already built out are part of the Environmental Baseline and water service from the LCRA's water pipeline will not change the impacts from this existing development. The indirect effects of increased water to existing development are impossible to quantify but should not result in incidental take. The build-out of those subdivisions and platted lots are currently planned under existing rules and regulations. Individual landowners would still be responsible for impacts from construction and urban development and LCRA has agreed to ensure that the landowners are notified of this responsibility. LCRA will also ensure that these landowners are provided with information to assist in complying with the Endangered Species Act (see Project description above).

EFFECT OF TAKE

In the accompanying biological opinion, the Service has determined that the level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification to critical habitat.

REASONABLE AND PRUDENT MEASURE / TERMS AND CONDITIONS

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take associated with the Northern Hays County and Southwestern Travis County Water Supply System. The measures described below are non-discretionary, and must be undertaken by the Corps so that they become binding conditions on the LCRA, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activities addressed by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions, or (2) fails to require the LCRA to adhere to the terms and conditions of the incidental take statement through enforceable terms and conditions, the protective coverage of section 7(o)(2) may lapse.

In order to monitor the impact of incidental take, the Corps, and/or LCRA must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement (below) [50 CFR §402.14(I)(3)].

In order to be exempt from the prohibitions of section 9 of the Act, the Corps and LCRA must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

Reasonable and Prudent Measure:

Monitor the effect of the proposed action on the warbler.

Terms and Conditions to Implement Reasonable and Prudent Measure:

1. Upon receipt of a request for water service, LCRA will work with the retail providers to ensure that notification letters will be given to all landowners within identified potential warbler habitat. LCRA will require landowner signature upon receipt of the notification materials. LCRA will provide copies of this documentation to the Service every six months.

2. LCRA will maintain a database to track implementation of the three options for landowners within potential warbler habitat.

3. Every five years, or sooner, LCRA and Service will work cooperatively to review the implementation and effectiveness of the three options for landowners within potential warbler habitat and make any modifications necessary.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

Conservation Recommendation 1: The Corps, LCRA, and other interested parties, with assistance from the Service, should participate in the regional planning effort for the Barton Springs watershed. Only with true regional planning, accomplished by private citizens, local, State, and Federal agencies and/or governments, will the issues at hand be fully addressed.

Conservation Recommendation 2: The Corps and LCRA are encouraged to participate, with the Service, in ongoing efforts by private citizens, local conservation groups, and local, State, and Federal agencies and/or governments to preserve land within the Barton Springs watershed. Land preservation in this watershed is the most beneficial way to protect the long-term water quality at Barton Springs. LCRA should consider dedicating some of the money generated by this water pipeline towards land preservation.

Conservation Recommendation 3: The Corps and LCRA both have other projects within the Barton Springs watershed. All projects should be used to further the protection of water quality within the Barton Springs watershed. Any projects should be carefully evaluated for potential water quality impacts. Specifically, the provision of water service and/or wastewater service to anywhere within the Barton Springs watershed should be evaluated for potential water quality impacts.

Conservation Recommendation 4: The Corps and LCRA are encouraged to participate in the Service's recovery planning process for the salamander that is currently underway. The Service is planning on completing this process within the next year. The Corps and LCRA are encouraged to fully participate in the development and implementation of the Barton Springs Salamander Recovery Plan.

Conservation Recommendation 5: The Corps and LCRA are encouraged to conduct presence/absence surveys for the warbler throughout the action area.

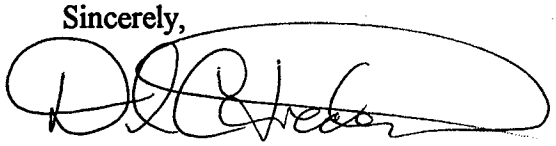
REINITIATION NOTICE

This concludes formal consultation on the proposed action of the Corps approval of the LCRA's Proposed Northern Hays County and Southwestern Travis County Water Supply System as outlined in your August 31, request for formal consultation and in other information provided the Service. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the

amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Thank you for your interest in protecting our federal trust resources. If you have any questions, please contact Matthew Lechner (512) 490-0057 or me.

Sincerely,



David C. Frederick
Supervisor

cc: Joseph Beal, General Manager, Lower Colorado River Authority

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APPENDIX 1.

MEMORANDUM OF UNDERSTANDING

Between
U.S. Department of the Interior
U.S. Fish and Wildlife Service

and

The Lower Colorado River Authority

for

THE PURPOSE OF PROVIDING SURFACE WATER
FOR RESIDENTS IN
WESTERN TRAVIS AND NORTHERN HAYS COUNTIES

I. BACKGROUND AND OBJECTIVES

1. The Lower Colorado River Authority (LCRA) is a conservation and reclamation district organized in the State of Texas with statutory authority and responsibility to provide water service to the portion of the Colorado River watershed lying generally within the Central Texas region and below (*i.e.,* LCRA's water service area).

2. LCRA, as part of its mission within its statutory district, has the authority and responsibility to take measures to protect and benefit the environment.

3. The mission of the U.S. Fish and Wildlife Service (USFWS) is to work with others to conserve, protect, and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people. The USFWS's major responsibilities are for migratory birds, endangered and threatened species, certain marine mammals, and freshwater and anadromous fish.

4. USFWS leads the federal effort to protect and restore animals and plants that are in danger of extinction both in the United States and worldwide. Under Section 2(c)(2) of the Endangered Species Act, it states that it is a "policy of Congress that Federal Agencies shall cooperate with the State and local agencies to resolve water resource issues in concert with the conservation of endangered species."

5. In fulfillment of its statutory mission, LCRA is proposing to construct a treated surface water pipeline (the "Water Pipeline") in western Travis and northern Hays counties to alleviate demand on inadequate water supplies from the area aquifers.

6. Due to recent drought conditions, an emergency condition exists in the area that can be served by the Water Pipeline. Municipal and domestic water supply wells are currently becoming unreliable due to draw down of the area aquifers. If predicted drought conditions continue, public health, safety and welfare will suffer from the lack of an adequate water supply.

7. Because of the emergency condition that currently exists LCRA believes that it is necessary to initiate construction of the Water Pipeline immediately. USFWS agrees to expedite section 7 consultation to ensure Endangered Species Act compliance for the Water Pipeline.

8. LCRA anticipates completion of the environmental impact study identified in paragraph III. 2., below, prior to completion of construction of the Water Pipeline, making information from the study available prior to actually initiating service to New Development. Therefore, LCRA will delay service to New Development, until the earlier of (i) 90 days after the date on which the environmental impact study is complete or (ii) January 1, 2002.

II. DEFINITIONS

1. Water Pipeline means the treated water transmission line that will serve customers in western Travis and northern Hays counties, as generally shown in Exhibit A, to the extent such service is to the recharge and contributing zones of the Barton Springs segment of the Edwards Aquifer.

2. Existing Development means a) any area served or to be served by the Water Pipeline pursuant to an agreement with LCRA executed on or prior to the effective date of this MOU; b) any house, commercial business, building, or other structure or improvement that exists or the construction of which has commenced on or prior to the effective date of this MOU; or c) any platted lot or approved residential development containing platted lots that has readily available electric utility service and direct access to an existing street or road on or prior to the effective date of this MOU.

3. New Development means a) any area, not existing development, served by the Water Pipeline pursuant to an agreement with LCRA executed after the effective date of this MOU; b) any house, commercial business, building, or other structure or improvement, not qualifying as Existing Development, that comes into existence or the construction of which commences after the effective date of this MOU; or c) any platted lot or approved development not qualifying as Existing Development.

III. AREAS OF COOPERATION AND PROCEDURES

1. LCRA agrees to participate, with the U.S. Army Corps of Engineers (Corps), in a formal section 7 consultation, as outlined in the Endangered Species Act, on the impact of pipeline construction and service to Existing and New Development with USFWS prior to initiation of pipeline construction.

2. LCRA agrees, with USFWS oversight, to commission and complete by October 1, 2001 an environmental impact study, the initial scope of which is shown in Exhibit B, to evaluate the impacts of New Development served by the water pipeline on water quality and the Barton Springs Salamander.

3. LCRA agrees to provide treated water service through the Water Pipeline only after completion of section 7 consultation. Water service to New Development will be provided only in conformity with the water quality protection measures approved by USFWS as part of section 7 consultation, unless USFWS has independently determined that the New Development will be in compliance with the Endangered Species Act.

4. The environmental impact study identified in paragraph 2 will fully evaluate the water quality protection measures approved during section 7 consultation, which measures may be modified with USFWS approval based on the environmental impact study, within 90 days following completion of the study.

5. After completion of section 7 consultation, USFWS if requested to do so by LCRA will provide written assurance to the Texas Water Development Board or other interested parties that the construction of, and the supply of water from, the Water Pipeline, as subject to the terms of this MOU, does not violate the Endangered Species Act.

6. Local governments are encouraged to initiate an effort to develop a regional solution for water quality protection in the Barton Springs watershed that will assure that New Development will be in compliance with the Endangered Species Act with respect to the Barton Springs Salamander. If such a regional solution, acceptable to USFWS, is developed, LCRA may provide service to New Development in compliance with approved regional standards, without the necessity of completing the environmental impact study identified in paragraph 2.

7. During section 7 consultation with the Corps, LCRA will submit as part of its project description and biological assessment the water quality protection measures attached as Exhibit C. USFWS, as part of its biological opinion, will review these water quality protection measures for New Development to be served from the Water Pipeline.

8. LCRA reserves the right, following section 7 consultation, to determine that it will not construct the water pipeline. If LCRA determines not to construct the water pipeline, this memorandum of understanding will be of no further force and effect and LCRA will be under no obligation to complete the environmental impact study.

IV. GENERAL PROVISIONS

1. The effective date of this Memorandum of Understanding (MOU) shall be the date of the latter signature below, and it shall remain in effect until the capacity of the Water Pipeline is committed and fully in service.

2. This MOU is a contract between the parties, made by LCRA under the authority of section 13 of the Lower Colorado River Authority Act, Section 2, Chapter 7, Acts of the 43rd Leg., 4th Called Session, 1934, as amended.

3. This MOU may be modified only upon the written agreement of both parties.

4. This MOU is binding upon successors in interest to LCRA and USFWS during the term of the MOU.

5. This MOU is subject to all valid rules, regulations and laws applicable hereto passed or promulgated by the United States of America, the State of Texas or any governmental body or agency having lawful jurisdiction or any authorized representative or agency of any of them. The parties agree that their obligations under this MOU shall include, and are conditioned upon, compliance with requirements made under said laws, and any rules and regulations issued pursuant thereto. Each party represents, warrants, covenants and agrees that it has full power and authority to enter into this agreement and that it has taken all requisite action provided by law.

6. The provisions of this MOU are severable, and if any provision or part of this MOU or the application thereof to any person or circumstance shall ever be held by any governmental agency or court of competent jurisdiction to be invalid or unconstitutional for any reason, the remainder of this MOU and the application of such provision or part of this MOU to other persons or circumstances shall not be affected thereby. However, if upon invalidation of any part of this MOU, either party believes that the purposes of the MOU have been frustrated, the parties agree to utilize best efforts to develop new provisions that will achieve the purposes of the MOU. If the parties cannot agree on new provisions, either party may cancel this agreement by 30 days written notice to the other party. Provided, however, if the MOU is cancelled, LCRA's ability to serve Existing Development shall survive cancellation of the MOU.

U.S. Fish & Wildlife Service

Date 5/17/2000

David C. Frederick
Supervisor

Lower Colorado River Authority

24 May 00
Date

Joseph J. Beal, P.E.
General Manager

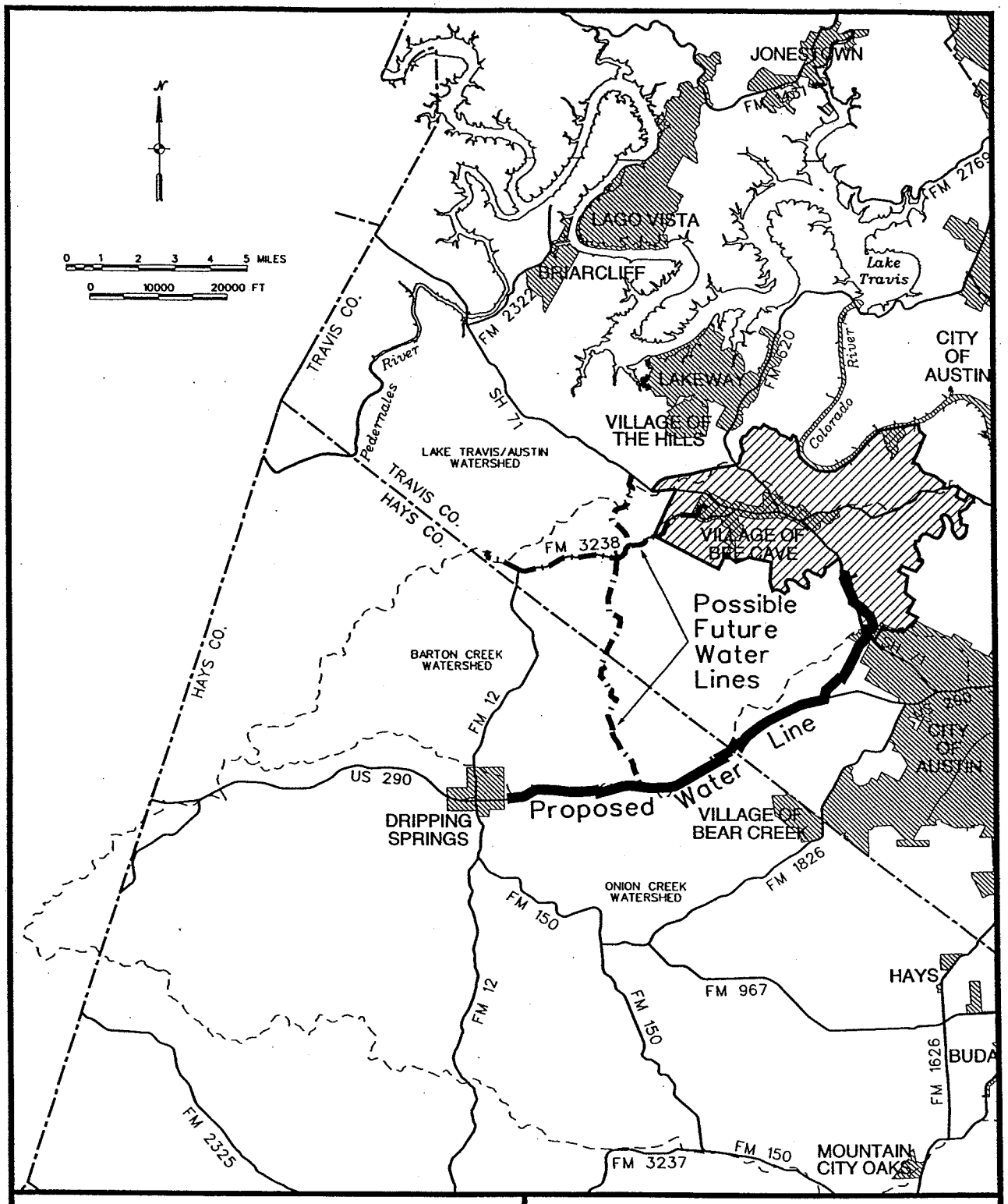

EXHIBIT A

LOWER COLORADO RIVER AUTHORITY

LCRA

THE POWER TO MAKE A DIFFERENCE.

Scale: See Bar Scale

Date: 5-16-2000

EXHIBIT "B"

PRELIMINARY SCOPE OF WORK
LCRA WEST TRAVIS/HAYS COUNTY WATER TRANSMISSION LINE PROJECT

1.0 GENERAL INFORMATION

1.1 PURPOSE AND NEED
1.2 PROJECT DESCRIPTION

2.0 EXISTING ENVIRONMENT

2.1 GEOLOGICAL ELEMENTS

2.1.1 Physiography
2.1.2 Geology
2.1.3 Energy and Mineral Resources
2.1.4 Soils
2.1.5 Prime Farmland

2.2 HYDROLOGICAL ELEMENTS

2.2.1 Surface Water
2.2.2 Ground Water
2.2.3 Edwards Aquifer Recharge and Contributing Zones

2.3 FLOODPLAINS AND WETLANDS

2.3.1 Floodplains
2.3.2 Wetlands and Jurisdictional Waters

2.4 CLIMATIC ELEMENTS

2.4.1 Climate
2.4.2 Air Quality

2.5 BIOLOGICAL ELEMENTS

2.5.1 Vegetation
2.5.2 Fish and Wildlife
2.5.3 Endangered and Threatened Species

2.5.3.1 Plant Species
2.5.3.2 Fish and Wildlife Species

2.6 HISTORICAL OR ARCHEOLOGICAL RESOURCES

2.6.1 Regional Overview
2.6.2 Records Review and Results

2.7 SOCIAL AND ECONOMIC CONDITIONS

2.7.1 Population

2.7.1.1 Current Data
2.7.1.2 Existing Population
2.7.1.3 Future Population Without Project

2.7.2 Social Characteristics

2.7.2.1 Social Characteristics of Population
2.7.2.2 Housing Characteristics

2.7.3 Economics

2.7.3.1 Leading Economic Sectors
2.7.3.2 Labor Force and Employment
2.7.3.3 Personal Income

2.7.4 Financial Conditions

2.7.5 Community Need

2.8 LAND USE, LAND USE PLANNING AND CONTROLS

2.8.1 Current Land Use

2.8.1.1 Urban Development
2.8.1.2 Agriculture
2.8.1.3 Parks and Recreation
2.8.1.4 Transportation
2.8.1.5 Residential
2.8.1.6 Schools
2.8.1.7 Water Service

2.8.2 Land Use Controls

2.8.2.1 TNRCC
2.8.2.2 The City of Dripping Springs
2.8.2.3 The City of Austin/Travis County

4.7.1 Population
4.7.2 Social Characteristics
4.7.3 Economic Characteristics

4.7.4 Financial Conditions
4.7.5 Community Need

4.8 LAND USE, LAND USE PLANNING AND CONTROLS

4.9 OTHER PROGRAMS AND PROJECTS

4.10 SECONDARY IMPACTS ASSOCIATED WITH THE PROJECT

4.10.1 Social and Economic Conditions

4.10.1.1 Population
4.10.1.2 Economic Characteristics
4.10.1.3 Financial Conditions

4.10.2 Land Use

4.10.2.1 Residential
4.10.2.2 Commercial/Industrial

4.10.3 Surface Water

4.10.3.1 Floodplains
4.10.3.2 Water Quality

4.10.4 Groundwater

4.10.4.1 Groundwater Demand
4.10.4.2 Groundwater Availability
4.10.4.3 Changes to Stream Base Flow
4.10.4.4 Edwards Aquifer Recharge
4.10.4.5 Groundwater Quality
4.10.4.6 Mitigation of Impacts

4.10.5 Evaluation of Water Quality Protection Scenarios

4.10.5.1 Existing Rules and Regulations
4.10.5.2 Current Water Quality Measures (Exhibit C to MOU)
4.10.5.3 Non-Degradation Measures (Attached as an appendix hereto)

Appendix to Scope of Work

Water Quality Protection Measures
(To be Analyzed in the Environmental Impact Study)

1. **Buffer Zones.**

Buffer zones (undisturbed natural areas) must be established for the stream drainage system and for sensitive environmental features within the Barton Springs watersheds. Buffer zones must remain free of construction, development, or other alterations. The number of roadways crossing through buffer zones must be minimized and constructed only when necessary to safely access property that cannot otherwise be accessed. Alterations that may take place within buffer zones include utilities, fences, public and private parkland and open space. Golf course development may not take place within a buffer zone.

A. Each stream, with a definable stream channel having a bed and bank, must have an undisturbed native vegetation buffer on each side of the stream as follows:

- Streams draining more than 640 acres (one square mile) must have a minimum buffer of 300 feet from centerline on each side of the stream.
- Streams draining less than 640 acres but more than 320 acres must have a minimum buffer of 200 feet from centerline on each side of the stream.
- Streams draining less than 320 acres must have a minimum buffer of 100 feet from centerline on each side of the stream.

B. Natural drainage channels lacking a bed and a bank but having a contributing drainage area greater than 40 acres must have a minimum buffer of 50 feet from the centerline on each side of the channel.

C. Sensitive environmental features must have a minimum buffer of 150 feet around the feature (radius). If the drainage to a feature is greater than 150 feet in length, then the minimum buffer must be 300 feet (radius). Sensitive environmental features include caves, sinkholes, faults, fractures, springs, seeps, or any area that holds water or supports mesic vegetation for sustained periods.

2. **Low-impact development designs.**

Recharge zone development must be limited to no more than 15% impervious cover in the upland zone. Contributing zone development must be limited to no more than 20% impervious cover in the upland zone. The upland zone includes all land and waters not included in a buffer zone or in improved, golf course turf areas.

Preservation of large, undisturbed upland areas through the use of innovative site design techniques that, for example, cluster development is encouraged. Lot averaging, which Hays County allows, encourages clustering. A cluster development should be located such that overland flow across preserved upland areas is maximized. Cluster development should also incorporate design principles that: reduce roadway widths; reduce residential street lengths using alternate street layouts that increase the number of homes per unit length; reduce residential street right-of-way widths; minimize

the use of residential street cul-de-sacs using alternative turnaround designs; use vegetated channels instead of curb and gutters; and use subdivision designs that incorporate, where appropriate, narrower lot frontages. Additional recommendations for low impact designs include the use of non-toxic building materials, water conservation, rainwater harvesting, wastewater recycling, and xeriscape.

3. **Provisions for increased development intensity.**

Onsite development intensity may be increased if additional land is acquired offsite. Such offsite land must be located in upland areas, and in the same watershed and aquifer zone as the development.

In the recharge zone, development may be allowed up to a maximum of 30% on-site impervious cover of the upland zone (developed site) when sufficient offsite land is provided. Such offsite land must be maintained in an undeveloped condition in perpetuity such that the effective impervious cover (developed land plus offsite land) does not exceed 10% impervious cover. In the contributing zone, development may be allowed up to a maximum of 35% on-site impervious cover of the upland zone when sufficient offsite land is provided. Such offsite land must be maintained in an undeveloped condition in perpetuity such that the effective impervious cover does not exceed 15% impervious cover. Improved, golf course turf areas must be excluded from the uplands area calculation and cannot be used to calculate allowable impervious cover. The required offsite acreage may be reduced when more sensitive land can be preserved; however, this consideration will be made only on a case-by-case basis.

Offsite land must be maintained in an undeveloped condition in perpetuity. Conservation easements or deed restrictions must be used to insure their permanent protection. Offsite lands must also have provisions made for third-party management, which could include a property owner, home-owners association, river authority, municipality, county or land trust. Offsite land should be in large contiguous areas and used to augment existing conservation and parkland efforts, to the greatest extent practical.

4. **Stormwater quality treatment.**

The stormwater management goal is to prevent degradation of the aquifer and surface waters by demonstrating compliance with specific non-degradation performance standards. Compliance with the non-degradation standards will be demonstrated by meeting the following two requirements.

- The development will not result in an increase in annual average stormwater pollutant loads over pre-development conditions for discharges from the site.

- The development will control streambank erosion by detaining post-development runoff to pre-development bankfull levels for discharges from the site.

Development with 10% or more on-site impervious cover in the uplands zone must utilize permanent, structural best management practices. Developments with less than 10% impervious cover may use vegetative buffers or other appropriate measures to meet the goal of non-degradation.

Compliance with the non-degradation standard will be presumed by demonstrating that post-development annual average pollutant loads are no greater than pre-developed loads for total suspended solids, total phosphorous and, for multi-family or commercial sites, oil & grease. This determination is to be made using the calculation procedures outlined in the Lower Colorado River Authority's Nonpoint Source Pollution Control Technical Manual, Third Edition (July 1998); note, however, that the required average annual removal efficiency will be 100% of any load over the pre-development level instead of the usual 70-75% removal standards. Capture volumes specified in the Nonpoint Source Pollution Control Technical Manual will need to be adjusted accordingly to meet the goal of non-degradation. Upon approval, alternative methodologies may also be used to demonstrate compliance.

Development with 10% or more on-site impervious cover must also protect against streambank erosion. Streambank erosion protection will be accomplished by capturing and detaining the 1-year, 3-hour storm event, and releasing it over a 24-hour or greater period.

5. **Construction-related erosion and sedimentation controls.**

Development must incorporate an erosion control plan in accordance with the temporary best management practices of the Nonpoint Source Pollution Control Technical Manual. Temporary erosion and sedimentation controls plans must also be applied to individual lots as they are developed through plat note or through other appropriate mechanisms.

6. **Maintenance plans.**

Plans for maintenance of structural water quality and erosion controls must be prepared and implemented in accordance with the Nonpoint Source Pollution Control Technical Manual. Documentation should be provided that insures that sufficient annual funding exists to properly maintain stormwater treatment facilities.

7. **Environmental education.**

An educational program must be implemented to inform the public about the sensitivity of the aquifer and their potential impacts on water quality. The developer or owner of the project must include within the development plans an environmental educational program for residential, industrial, and/or commercial developments. Topics may include information about endangered aquatic species, karst geology, best management practices, buffer zone maintenance, fertilizer application, pesticide use, organic gardening, and disposal of hazardous household chemicals. Materials used should be obtained from the Service, TNRCC, American Water Works Association, National Ground Water Association, Water Environment Federation, or from another appropriate source. Development of kiosks, displays, video, and/or other media to present material covering a variety of non-point source pollution control topics should be encouraged. Alternative educational efforts, such as site-specific recharge feature displays and educational nature trails should also be encouraged. Similarly, all developments should include an integrated pest management plan to minimize exposure of stormwater runoff to chemicals (fertilizers, herbicides and pesticides).

EXHIBIT "C"

Water Quality Protection Measures

1. Buffer Zones. Buffer zones (undisturbed native vegetation buffer) should be established for the stream drainage system and sensitive environmental features within the Barton Springs zone. Buffer zones should remain free of construction, development, or other alterations. The number of roadway crossings of stream buffer zones should be minimized and constructed only when necessary to provide access to property that cannot otherwise be safely accessed. Other alterations that may take place within buffer zones include utilities, fences, and public and private parks and open space.

A. Each stream, with a definable stream channel having a bed and bank, should have an undisturbed native vegetation buffer on each side of the stream as follows:

i. streams draining greater than one square mile (640 acres) of area should have a minimum buffer of at least 300 feet from centerline of the waterway on each side of the stream;

ii. streams draining less than one square mile, but more than ½ square mile, should have a minimum buffer of at least 200 feet from centerline on each side of the stream;

iii. streams draining less than ½ square mile should have a minimum buffer of at least 100 feet from centerline on each side of the stream.

B. Natural drainage channels lacking a bed and a bank but having a contributing drainage area greater than 40 acres should have a minimum buffer of 50 feet from the centerline on each side of the channel.

C. Sensitive environmental features should have a minimum buffer of 150 feet (radius). If the drainage to a feature is greater than 150 feet in length, then the minimum buffer should be 300 feet (radius). Sensitive environmental features include caves, sinkholes, faults, fractures, springs, seeps, or any area that holds water or supports mesic vegetation for sustained periods.

2. Low-impact development designs. Development in the recharge zone should be limited to less than or equal to 15% impervious cover in the upland zone. Development in the contributing zone should be less than or equal to 20% impervious cover in the upland zone. The upland zone includes all land and waters not included in a buffer zone.

3. Provisions for increased development intensity. Development in the recharge zone may be increased to no more than 30% on-site impervious cover of the upland zone (developed site) when sufficient off-site land is provided and maintained in an undeveloped condition in

perpetuity such that the effective impervious cover (developed land plus off-site land) does not exceed 10% impervious cover. Development in the contributing zone may be increased to no more than 35% onsite impervious cover of the upland zone (developed site) when sufficient off-site land is provided and maintained in an undeveloped condition in perpetuity such that the effective impervious cover (developed land plus off-site land) does not exceed 15% impervious cover. This land should be provided in the same watershed (Barton, Little Barton, Bear, Little Bear, Slaughter, Onion, or Williamson) as the development and the same aquifer zone (recharge or contributing) as the development. The amount of additional acreage needed to avoid impacts may be less if more sensitive land is preserved; however, this would have to be assessed by the Service on a case-by-case basis.

4. **Construction-related erosion and sedimentation controls.** Development should incorporate an erosion control plan in accordance with the temporary best management practices of the Edwards Aquifer Rules (Texas Water Code, Chapter 213) and Technical Guidance Manual on Best Management Practices (June 1999, TNRCC, RG-348).

5. **Stormwater quality treatment.** Development with 10% or more on-site impervious cover in the uplands zone should provide permanent best management practices to meet the performance standards of the Edwards Aquifer Rules and Technical Guidance Manual. These rules require implementation of best management practices to remove 80% of the increase in total suspended solids load resulting from development. In addition, the vegetative swales non-structural best management practice should be applied below structural controls to further reduce dissolved materials, where structurally practical.

Development with 10% or more on-site impervious cover should also provide streambank erosion control by capturing and detaining the 1-year, 3-hour storm event (See Technical Guidance Manual on Best Management Practices, June 1999, TNRCC, RG-348) and releasing it over a 24-hour or greater period.

Developments with less than 10% impervious cover should use the vegetative swales and filter design measures in the Edwards Aquifer Technical Guidance Manual to convey stormwater off of the site and meet the performance standards of the Edwards Rules.

6. **Maintenance plans.** Plans for maintenance of structural water quality and erosion controls should be prepared and implemented in accordance with the Edwards Aquifer Rules. In addition, all developments should employ the non-structural best management practices to the maximum extent practical.

7. **Environmental education.** Educational efforts should be implemented to inform the public about the sensitivity of the aquifer and their potential impacts to the water quality. The developer or owner of the project should include within the development plans an environmental educational program for residential, industrial, and/or commercial developments in the Barton Springs zone. Topics could include the Barton Springs salamander, karst geology, best management practices, buffer zone maintenance, fertilizer application, pesticide use, organic gardening, and disposal of hazardous household chemicals. Materials used should be obtained

from the Service, TNRCC, American Water Works Association, National Ground Water Association, Water Environment Federation, or other sources, as approved by the Service. Development of kiosks, displays, video, and/or other media to present material covering a variety of non-point source pollution control topics should be encouraged. Alternative educational efforts, such as site-specific recharge feature displays and educational nature trails should also be encouraged. Similarly, all developments should encourage integrated pest management plans to minimize exposure of stormwater runoff to chemicals (fertilizers, herbicides, pesticides, etc.).

APPENDIX 2.

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Sherri Kuhl
Lower Colorado River Authority
P.O. Box 220
Austin, Texas 78767-0220

September 13, 2000

Subject: Habitat Assessment for LCRA Southwest Travis County Water Line, Highway 71 Water Storage Tank to Dripping Springs
BCCP Project # I. LCRA.00.003

Dear Ms. Kuhl,

Thank you for your application to construct a major water transmission line from the LCRA 1015 water storage tank near the SH 71 and Southwest Parkway intersection to a new storage tank site (LCRA 1280) located on US Highway 290 east of Dripping Springs. The pipeline route will run through portions of Travis and Hays Counties, usually within or parallel to existing highway or street rights-of-way. Within Travis County, over 40,000 linear feet or 7.6 miles of 24-inch diameter, ductile iron transmission main will be installed . Thirty to forty foot wide utility easements will be necessary along the route of the Southwest Travis County Water Line to allow for necessary construction access, spoils storage and placement of this buried water pipeline.

For the first 1.5 mile pipeline segment, the project route generally follows the west side of State Highway 71 between the LCRA 1015 water tank and Midwood Parkway. Along this segment, the pipeline passes the Barton Creek Habitat Preserve, a designated component of the Balcones Canyonlands Preserve owned by the Nature Conservancy of Texas, within the planned roadway/infrastructure corridor for SH 71, but parallel to the current right-of-way. After the pipeline leaves the SH 71 right-of-way, the water pipeline does not lie within any other portion of the Balcones Canyonlands Preserve acquisition area. These segments within Travis County are eligible for mitigation under the Balcones Canyonlands Conservation Plan (BCCP) infrastructure program for covered entities; however, pipeline segments to the west in Hays County lie outside the BCCP permit coverage and are not eligible. As mentioned in your application, the U.S. Fish and Wildlife Service will need to be consulted for any endangered species habitat issues and mitigation along the Hays County portion of the route.

The project route as shown on your project plans lies entirely within Zone 2 (potential) golden cheeked warbler habitat, an endangered songbird that is protected by the BCCP regional permit, or Zone 3 non-habitat. The linear extent of the water pipeline route through Zone 2 habitat totals approximately 22,000 linear feet. In addition, the current habitat zone map from Travis County shows no outcrops of karst habitat along the project route and no designated BCCP caves slated for protection are located nearby.

The pipeline project will require the removal of vegetation from the 30-foot wide easement along the State Highway 71 segment and 40-foot wide private easements outside the current right-of-way for US Highway 290. The proposed route between the two major highways will involve use of a 40-foot wide path that follows existing street rights-of-way and some new private easement acquisition. The booster pump station will be built along the pipeline corridor on a 1.6-acre tract near the Travis/Hays county line that is classified as Zone 2 habitat (0.8 acres) and non-habitat.

The total easement area within Zone 2 habitat is 783,000 square feet: 291,000 square feet for the State Highway 71 segment and another 492,000 square feet within the remainder of the pipeline route leading to the Travis Hays County line. The total mitigation requirement amounts to 18.8 acres of Zone 2 warbler habitat. Under the BCCP infrastructure mitigation procedure, 9.4 acres of Zone 1 equivalents will be deducted from the LCRA's mitigation credit balance in the Balcones Canyonlands Conservation Plan (BCCP).

This project may participate under the BCCP regional permit and infrastructure construction in habitat areas may begin after September 1. Mitigated project participation under the regional permit requires that habitat clearing occur during the non-bird season (September 1 through the end of February); however, if the habitat has been cleared along the route before the birds return to their nesting habitats after March 1 each year, other aspects of the construction activity are allowed to continue beyond the regulatory deadline. In the unlikely event that the trenching work for this transmission main exposes any caves or significant subsurface voids, the project proponent should cease construction and notify the Austin Ecological Services office of the U.S. Fish and Wildlife Service (512-490-0063) for guidance on protecting potential karst habitat. These two requirements are standard for BCCP infrastructure participation.

The proposed pipeline will be passing near areas known to have oak trees infected with oak wilt. It is important that any clearing or vegetation trimming activity along the route follow proper oak wilt prevention protocols to prevent the spread of this dangerous fungal infection. It is especially critical along the State Highway 71 segment where the pipeline easement passes through the Nature Conservancy's Barton Creek Habitat Preserve. Although the application did not include construction-level plans with detailed tree info, it is assumed that the LCRA will also be using its practice of selectively cutting the larger trees within its easement only if necessary to the conduct of the proposed project construction.

Thank you for your continuing interest in the BCCP infrastructure program. This letter will serve as your authorization to proceed with project clearing and construction under the BCCP regional permit. If you have any further questions, please feel free to call me at 402-1252.

Sincerely,

Melvin O Hinson, Jr.

Melvin O. Hinson, Jr.
BCCP Infrastructure Coordinator

CC: Don Koehler, PARD
Sybil Vosler, USFWS
Travis County TNR
Jeff Francell, TNC
File # I.LCRA.00.003

Appendix 3.

Process for Ensuring Compliance Under the Endangered Species Act for Build-out of Remaining Lots Within Golden-cheeked Warbler Habitat in Existing Developments to be serviced by the LCRA Waterline (see Project Description, Option 3.a.).

- Clearing for each home site (including house, lawn, garden, outbuildings, etc.) and associated infrastructure on each lot will be limited to 0.75 acres.

- Clearing of vegetation warbler habitat will be done only during the non-breeding season (August 1 through March 1 of each year), unless breeding season surveys performed by a Service-permitted biologist indicate that no warblers are present within 300 feet of the desired activity.

- Clearing and construction shall be consistent with the current practices recommended by the Texas Forest Service to prevent the spread of oak wilt.

- Each lot owner will contribute $1,500 for the construction of each house per lot to either the Balcones Canyonlands Preserve (BCP) OR the National Fish and Wildlife Foundation (NFWF). Funds will be used for the specific purpose of land acquisition/management for conservation of warblers. Prior to initiating any clearing or construction, a copy of the receipt for payment to the BCP or NFWF, along with the landowner's name, subdivision name, and lot number, must be submitted to the Supervisor, U. S. Fish and Wildlife Service, 10711 Burnet Road, Suite 200, Austin, Texas 78758.

For payments to the BCP, landowners must contact Travis County (512/473-9383). The BCP is a regional habitat conservation plan developed by the City of Austin and Travis County to set aside and manage large tracts of land for the warbler, as well as endangered vireo and caves invertebrates and other rare species. The BCP has been established since the Service issued a permit to the City of Austin and Travis County in 1996.

For payments to NFWF, landowners will provide a check or money order to the National Fish and Wildlife Foundation, 1120 Connecticut Ave., N.W., Suite 900, Washington, D.C. 20036. The following information must be on the check or money order: the landowner's name, and the subdivision name and lot number. Each payment must include REF# 2000-178, Golden-cheeked Warbler Conservation Fund.

The primary purpose for establishing the NFWF Fund is to provide an avenue for payment exclusively for the conservation and recovery of the warbler, including acquisition and management of habitat. NFWF is a private, not-for-profit conservation organization established by Congress in 1984. While NFWF manages the Fund at the direction of the Service, the Service is not a recipient of any monies provided to this Fund, nor does it derive any benefit other than assisting local citizens and communities with conservation and recovery efforts. NFWF will hold all monies in the Fund until funds accrue to a point that they can be used to purchase lands identified by the Service as being important for preservation of the warbler.

Appendix 4. Interim Water Quality Protection Measures

U.S. Fish and Wildlife Service
Recommendations for Protection of
Water Quality of the Edwards Aquifer

September 1, 2000

These recommendations were produced with the intent of identifying measures that would achieve an objective of "non-degradation" of water quality for projects within the Edwards Aquifer. While true "non-degradation" is not technically possible today, these recommendations strive to maintain current water quality. Anyone implementing projects following these recommendations is encouraged to go beyond water quality maintenance and demonstrate ways that the project can achieve improved water quality.

These recommendations to protect water quality are current as of the date listed above and will change as new information becomes available. They are not rules, regulations, laws or requirements. These recommendations were formulated by reviewing existing scientific information, existing rules and regulations, and by working closely with water quality engineers and biologists. These recommendations pertain to the protection of water quality for Federally listed endangered and threatened species. These measures do not address other possible impacts to Federally listed endangered or threatened species.

It is recognized that strict adherence to any general set of development recommendations may be problematic at the project level. Problems that arise are usually very site-specific and should be dealt with on a case-by-case basis. Variations from these recommendations could be used and still achieve the "non-degradation" objective. In cases where flexibility is appropriate, variations should be designed to achieve the "non-degradation" objective.

1. Buffer Zones.

Buffer zones (undisturbed natural areas) should be established for the stream drainage system and for sensitive environmental features within the Edwards Aquifer watersheds.

A. Buffer zones should remain free of construction, development, or other alterations. The number of roadways crossing through the buffer zones should be minimized and constructed only when necessary to safely access property that cannot otherwise be accessed. Other alterations within buffer zones could include utility crossings, but only when necessary, fences, low impact parks, and open space. Low impact park development within the buffer zone should be limited to trails, picnic facilities, and similar construction

that does not significantly alter the existing vegetation. Parking lots and roads are not considered low impact. Neither golf course development nor wastewater effluent irrigation should take place in the buffer zone. Stormwater from development should be dispersed into overland flow patterns before reaching the buffer zones.

B. Each stream should have an undisturbed native vegetation buffer on each side as follows:

Streams draining 640 acres (one square mile) or greater should have a minimum buffer of 300 feet from the centerline on each side of the stream.

Streams draining less than 640 acres but 320 or more acres should have a minimum buffer of 200 feet from the centerline on each side of the stream.

Streams draining less than 320 acres but 128 or more acres should have a minimum buffer of 100 feet from the centerline on each side of the stream.

Streams or swales draining less than 128 acres but 40 or more acres should have a minimum buffer of 50 feet from the centerline on each side of the drainage.

Streams or swales draining less than 40 acres but 5 or more acres should have a minimum buffer of 25 feet from the centerline on each side of the drainage.

C. Sensitive environmental features should have a minimum buffer of 150 feet around the feature (radius). If the drainage to a feature is greater than 150 feet in length, then the minimum buffer should be expanded to a minimum of 300 feet for the area draining into the feature. Sensitive environmental features include: caves, sinkholes, faults with solution-enlarged openings, fracture zones with solution-enlarged openings, springs, seeps, or any area that holds water or supports mesic vegetation for sustained periods. Possible sensitive features and sensitive features as defined by the "Instructions to Geologists for Geologic Assessments on the Edwards Aquifer Recharge/Transition Zones", TNRCC document 0586 (Rev. 6/1/99) should have these buffers established.

2. **Low-impact development designs.**

Low-impact development design is defined not only by impervious cover, but also by a philosophy of development planning, engineering design and construction, and tenant occupation that reduces the impact upon the surrounding environment. The goal of low-impact development design is to produce a product with the least effect upon the natural biota and the hydrologic regime of the site. A source of guidance for such design may be obtained from Low-Impact Development Design Manual (hereafter LIDDM), Department of Environmental Resources, Prince George's County, Maryland, November 1997. Site specifics will affect the applicability of the measures to the Central Texas area.

Recharge zone development should be limited to no more than 15% impervious cover in the uplands zone. Contributing zone development should be limited to no more than 20% impervious cover in the uplands zone. The uplands zone includes all land not within a buffer zone and not within golf course turf areas subject to fertilizer, pesticide and herbicide applications. Buffer zones and golf course turf areas should not to be included in impervious cover calculations.

Preservation of large, undisturbed upland areas through the use of innovative site design techniques that, for example, cluster development is encouraged. Cluster development should also incorporate design principles that: reduce roadway widths; reduce residential street lengths using alternate street layouts that increase the number of homes per unit length; reduce residential street right-of-way widths; minimize the use of residential street cul-de-sacs using alternative turnaround designs; use vegetated channels instead of curb and gutters; and use subdivision designs that incorporate, where appropriate, narrower lot frontages. Additional recommendations for low impact designs include the use of non-toxic building materials, water conservation, rainwater harvesting, wastewater recycling, and xeriscaping.

3. Provisions for increased development intensity.

Onsite development intensity may be increased if additional land, conservation easement, or development rights are acquired offsite. Offsite land should be located in the same watershed and aquifer zone as the development. Offsite land being used to offset higher development on a project should not include areas that would be part of a buffer system under these recommendations.

In the recharge zone, development should not exceed a maximum of 30% on-site impervious cover of the upland zone (developed site) when sufficient offsite land is provided. Such offsite land should be maintained in an undeveloped condition (25 acre tracts or larger) in perpetuity such that the effective impervious cover (developed land plus offsite land) does not exceed 10% impervious cover. In the contributing zone, development should not exceed 35% on-site impervious cover of the upland zone when sufficient offsite land is provided. Such offsite land should be maintained in an undeveloped condition in perpetuity such that the effective impervious cover of the combined tracts does not exceed 15%. Golf course areas receiving fertilizer, pesticide, and herbicide applications should be excluded from the uplands area calculation and should not be use to calculate allowable impervious cover. The offsite acreage may be reduced when more sensitive land can be preserved; however, this consideration should be made on a case-by-case basis.

Offsite land should be in a low impervious cover condition (2 percent or less) in perpetuity. Conservation easements or deed restrictions should be used to ensure permanent protection. Offsite lands should also have provisions made for appropriate long term management, which

could include a property owner, home-owners association, river authority, municipality, county or land trust. Offsite land should be in large contiguous areas and used to augment existing conservation efforts, to the greatest extent practical.

4. **Stormwater quality treatment.**

The stormwater management goal should be to prevent degradation of the aquifer and surface water by meeting specific non-degradation performance objectives. Satisfying the non-degradation goal should be demonstrated by meeting the following two objectives:

The development should not result in an increase in annual average stormwater pollutant loads over pre-development conditions for discharges from the site.

The development should preserve the current form and function of the drainage network/stream system. This may be achieved by either non-structural or structural means, depending upon the nature of the development.

The use of vegetative practices is encouraged to meet the goals of non-degradation and erosion control. Key to the success of vegetative practices is providing a low impact development design incorporating elements that more closely mimic the existing hydrologic setting. Developments or portions of developments at 10% impervious cover or lower should be able to achieve such designs. Non-structural approaches are encouraged whenever feasible in order to avoid concentrating runoff patterns. Relying primarily on vegetative and other non-structural approaches increases the likelihood of long-term water quality protection as well as minimizing future maintenance responsibilities. Developments or portions of a development with impervious cover greater than 10% are encouraged to rely on such practices to achieve non-degradation, though it is understood that permanent, structural best management practices should be employed in many instances. When non-structural controls are used to achieve non-degradation, then it should be demonstrated for streambank erosion that the pre-development levels of stream flow are maintained for streams draining at least 40 acres. If the site to be developed lies within a contributing area of less than 40 acres, or if there is no defined channel at the outlet, then pre-development levels of flow should be maintained for the point(s) of the greatest drainage area within the development. When structural controls are used, capturing the runoff from the 1-year, 3-hour storm event, and releasing it over a 24-hour or greater period should accomplish stream channel erosion protection.

5. **Construction-related erosion and sedimentation controls.**

Development should incorporate an erosion control plan in accordance with the temporary best management practices of the Nonpoint Source Pollution Control Technical Manual and/or the Technical Guidance Manual on Best Management Practices (June 1999, TNRCC, RG-348). Temporary erosion and sedimentation control plans should also be applied to individual lots as they are developed through appropriate mechanisms.

6. **Maintenance plans.**

Plans for maintenance of structural water quality and erosion controls should be prepared and implemented in accordance with the Nonpoint Source Pollution Control Technical Manual and/or the Technical Guidance Manual on Best Management Practices (June 1999, TNRCC, RG-348). Documentation should be provided that ensures that sufficient annual funding exists to properly maintain stormwater treatment facilities.

7. **Environmental education.**

An educational program should be implemented to inform the public about the sensitivity of the aquifer and their potential impacts on water quality. The developer or owner of the project should include within the development plans an environmental educational program for residential, industrial, and/or commercial developments. Topics may include information about endangered aquatic species, karst geology, best management practices, buffer zone maintenance, fertilizer application, pesticide use, organic gardening, and disposal of hazardous household chemicals. Materials used should be obtained from the Fish and Wildlife Service, TNRCC, American Water Works Association, National Ground Water Association, Water Environment Federation, or from another appropriate sources. Development of kiosks, displays, video, and/or other media to present material covering a variety of non-point source pollution control topics should be encouraged. Alternative educational efforts, such as site-specific recharge feature displays and educational nature trails should also be encouraged. Similarly, all developments should include an integrated pest management plan to minimize exposure of stormwater runoff to chemicals (fertilizers, herbicides and pesticides).